# U.S. DEPARTMENT OF AGRICULTURE

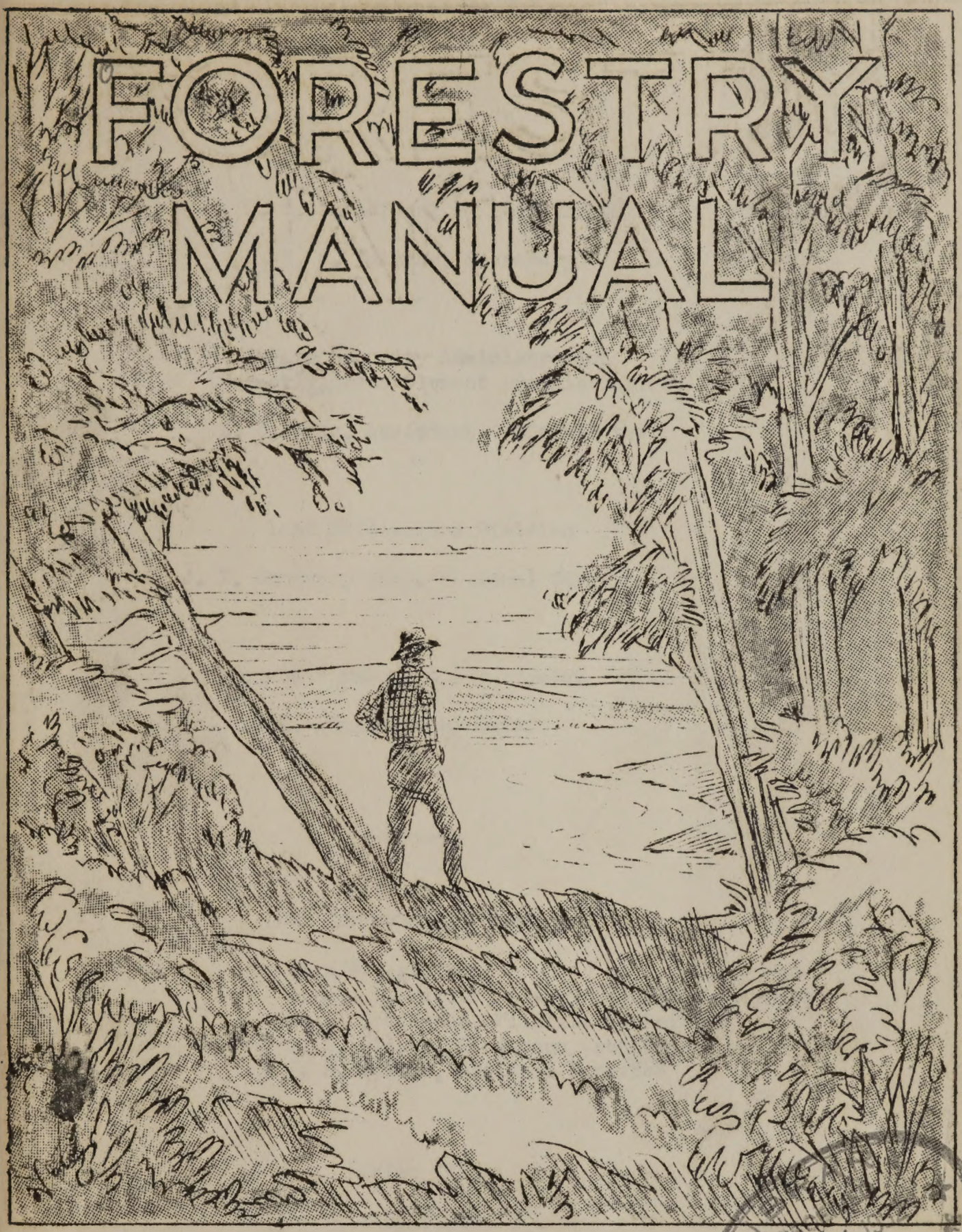
# FARM SECURITY ADMINISTRATION



# FORESTRY HANDBOOK

## LAND UTILIZATION REGION 8

# FORESTRY MANUAL



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REGION 8

# Forestry Manual

## For the Guidance of Project Managers

## and

## Such of the Project Personnel As are Entrusted with the Carrying Out of This Work

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Region V111

Resettlement Administration

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Region VIII

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MANUAL FOR FORESTRY WORK

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# Forestry Manual

## Foreword

The purpose of compiling this forestry manual is to get together the suggestions that have been sent out from time to time by the Regional Office covering various phases of the forestry work and put them in a form for ready reference by the Project Managers and such of the personnel on the project areas as are entrusted with planning for or carrying out the forestry work.

Where methods of construction and general plans in use by the Forest Service, U. S. Department of Agriculture, are suggested as the best usage to follow, and Forest Service Manuals covering such usage have been supplied to the projects, the subject covered is only touched upon where slight deviations or changes seem advisable to meet the especial needs of Region Vlll.

# FOREST FIRE CONTROL

## General

The forest cover on the project areas constitutes a real asset in that it prevents soil erosion decreases and regulates surface run-off, retards evaporation and builds up the humus content of the soil. All this is an important matter in view of the lakes which are being constructed or have been constructed on the project areas, where the purity of the water and the silting up of the reservoirs are major considerations. The timbered areas also provide such material products as posts, poles and lumber. In addition they furnish shelter and food for wildlife and shade and beauty for lovers of the out-of-doors, who may seek recreation on the project areas.

The present forested areas on the project areas show very plainly the injurious effects of forest fires in the past. A majority of the trees are scarred at the butt and have been seriously affected by rot, which has resulted because of fire damage. Destructive insects have also found it possible to work on the trees because of lowered vitality resulting from injuries. The composition of the forested areas has deteriorated because of the destruction of valuable reproduction and tree seeds of desirable species. The humus and ground litter has been destroyed almost entirely.

Any effort, therefore, directed toward regeneration and improvement of the forest stand or preservation of present forest areas must be based on adequate forest fire control. Until recently no systematic effort has been in effect to prevent or suppress forest fires, nor has any adequate record been kept of such fires as have occurred. An effort is here made to furnish such information as will furnish the basis for a systematic fire plan and furnish some needed instructions to the men on the project areas who are directly in charge of this work.

Forest Fires

1. Such fires as occur in this region will ordinarily be "ground" fires; that is, the fires will run on the ground destroying leaves, litter and humus. Forest fires will seldom be "crown" fires, burning in the branches and tops of trees.

To control forest fires, therefore, fire lanes should be cleared ahead of the fire, so that such lanes are free of all dead and down material, leaves and litter of all sorts, in which a fire will burn. These lanes should be of sufficient width to prevent the fire from jumping and sufficiently far enough ahead of the original fire to give the opportunity for the completion of the fire lanes before the or-

iginal fire reaches them. They may be further increased in effectiveness by back-firing. After the fire lane has been constructed and the fire has reached it, the lane should be patrolled to see that no fire or sparks get over it. Indian fire pumps are very effective in such work and in the extinguishing of burning dead snags or logs within the burned area from which sparks might be thrown to adjacent unburned area. All dead, burning snags within a distance of at least 50 feet of the fire lane should be cut down, since such snags throw sparks for surprisingly long distances and start fires outside the area to which the fire has been confined.

Only experience will show the most effective way of fighting a forest or grass fire. Every man in charge of this work should study the technique of this job - for there is a real technique in effectively extinguishing fires - with a view to extinguishing a fire in the shortest possible space of time, and with the least loss of forest cover or grass. It pays in the long run, if the fire is extensive, to make a complete survey of the situation before control measures are begun, since in this way a lot of time and effort may be saved. Also, the study of a fire after it is finally out may disclose methods or means by which the particular fire might have been controlled more quickly and with less effort and suggest better methods for use in future fires.

A fire should never be left until it is completely out - that is, safe. By this it is not meant that every smouldering log within the interior of the fire should be extinguished; but such snags and logs close to the boundary of the fire, which might throw sparks beyond the burned area to adjacent unburned areas, should be extinguished. This, in the long run, is a saving of time and effort.

2. In any fire protection activity, one of the first necessities is the early detection of forest fires, while they are small and easily extinguished. This is accomplished in one of several ways:

(a) By a system of fire patrol of the area which is being protected.

(b) By observation from a point of vantage, such as a high hill or mountain, a lookout tower or a tree.

(c) By notification from outside parties by phone, personal contact or by mail.

Any system of patrol, even by automobile, has its disadvantages, since a patrolman may be at one end of his patrol route when a fire starts at the other, and considerable time may elapse before the fire is finally discovered.

By far the most effective means of locating fires is by observation from some point of vantage, such as a high hill or ridge, a high tree or a tower. A fire tower, sufficiently high to overlook the sur-

rounding country for several miles in all directions, is easily the most desirable fire lookout. To make such a lookout thoroughly effective, it should be connected by phone with some control point where men or crews for fighting fire are available.

Notification from outsiders about the occurrence of forest fires, whether by phone, by personal contact, or by mail, is an uncertain matter, and not to be depended upon. Except by telephone, such a method is to be used largely as an adjunct to the first two plans mentioned.

The quick detection of forest fires and the rapid transportation of fire fighting crews to the location of the fire stand out as the primary requisites in any plan for fire control.

3. Forest Fire Records. It is only by keeping accurate records of forest fires that occur that adequate measures may be taken to cope with and prevent forest fires. For example, a study of the reports covering fires may show that a very large percentage of forest fires occur in a certain area, and that the cause of practically all of these fires is carelessness on the part of picnickers, campers, tourists or others. A careful study of this particular situation may disclose the fact that additional fire breaks are needed to prevent the spread of fires and confine them to small areas. Also, it may

indicate that the present system of fire patrol and detection for that particular area is not as intensive as the situation demands. And, further, it shows the necessity of an active campaign with the public that uses the area to make it aware of the destructive and far-reaching results of its carelessness.

Careful and adequate records and reports may also disclose other faults in the fire plan in operation that should be corrected, such as the inefficiency of a single individual, which causes a breakdown in the effectiveness of the entire plan. Too much stress cannot, therefore, be laid on accurate fire reports made up from first-hand information, obtained by the person himself who makes the report.

## Fire Reports

Estimating the damage done by forest fires. One of the most difficult features of reporting accurately forest fires is some systematic way of arriving at the damage done. The following aid in this direction is largely an excerpt from the Texas Forest Service "Manual of Instructions", and will serve all purposes for the present at least.

1. Damage to merchantable timber may be divided into two classes.

a. Damage which results in the immediate or early death of the trees

b. Damage which decreases the amount or quality of merchantable timber in the trees, but does not result in their death.

2. By fire-killed merchantable timber is meant timber of the following classes:

a. Trees entirely killed by fire, either standing or blown down as a result of burning at the base

b. Trees so severely burned at the base that it can be safely stated that they will be blown down within a very short time.

c. Trees so severely scorched that it is certain they will die within a short period.

All merchantable trees within the above classes will be considered a total loss, and the damage figured according to Table No. 1.

Damage Table for Merchantable Growth. This table is based on stumpage values of $5.00, $7.50 and $10.00 per thousand feet, B. M. In order to use the table three things must be known:

a. Number o f trees killed

b. Prevailing stumpage value of the locality

c. Diameter at breast high; that is, 4½ feet from the ground, of the trees killed.

Table No. 1. (See Note at bottom of Page)

| *Diameter of trees 4½ feet from ground | Broad Feet | Value of trees per 1,000 B. M. @ $5.00 | @$7.50 | @$10.00 |
|---|---|---|---|---|
| 10 | 25 | .15 | .20 | .25 |
| 12 | 50 | .25 | .40 | .50 |
| 14 | 80 | .40 | .60 | .80 |
| 16 | 140 | .70 | 1.05 | 1.40 |
| 18 | 205 | 1.05 | 1.55 | 2.05 |
| 20 | 265 | 1.35 | 2.00 | 2.65 |
| 22 | 340 | 1.70 | 2.55 | 3.40 |
| 24 | 420 | 2.10 | 3.15 | 4.20 |
| 26 | 520 | 2.60 | 3.90 | 5.20 |
| 28 | 630 | 3.15 | 4.75 | 6.30 |
| 30 | 760 | 3.80 | 5.70 | 7.60 |
| 32 | 890 | 4.45 | 6.68 | 8.90 |
| 34 | 1020 | 5.10 | 7.65 | 10.20 |
| 36 | 1150 | 5.75 | 8.65 | 11.50 |

*Note: If a tree is an odd number of inches in diameter (for example, 17 inches), it will be figured at the next highest even figure.

Example: A fire burning over an area of merchantable timber killed 10 trees 12 inches in diameter, five trees 14 inches in diameter, and one tree 32 inches in diameter. The local stumpage rate is $5.00 per thousand B. M. What was the damage?

By referring to Table No. 1, trees 12 inches in diameter are shown to contain 25 feet, b. m., each with a value of $5.00 per M of 25 cents each. Ten trees would, therefore, contain 250 feet, B. M. with a value of $5.00 per M or $2.50. Five 14 inch trees contain 5 x 80 feet, B. M. or 400 feet, B. M. At $5.00 per M five 14 inch trees are

Note: Since no figures are at present available covering growth and yield for the character of stand generally found in the region in which the projects in Region VIII are located, purely arbitrary figures have been used.

worth 5 x 40 cents, or $2.00. Our 32 inch tree contains 890 feet B. M. and is worth $4.45 at $5.00 per M. The fire, therefore, caused the following amount of damage to merchantable growth.

| | | | |
|---|---|---|---|
| | 250 ft. B. M. | | $2.40 value |
| | 400 ft. B. M. | | 2.00 value |
| | 890 ft. B. M. | | 4.45 value |
| Total | 1540 ft. B. M. | Total | 8.95 value |

Therefore, the total damage to merchantable growth is 1540 feet B. M. with a total value of $8.95 at a stumpage value of $5.00 per thousand board feet.

Damaged Timber. Very often standing merchantable timber is injured in such a manner that the death of the trees does not result. Deep injuries are burned into the base of the trees, which recult in bad scars and the consequent reduction of timber in the butt logs. In figuring the damage in such cases it is necessary first to estimate what percentage of the stand has been damaged. If, for example, a stand averaging 10,000 B. M. per acre has been so severely burned at the base on 40 acres that the stand scales 10% less after the fire than before it, the original scale would be 10,000 ft. B. M. x 40 or 400,000 ft. B. M. Ten per cent of 400,000 would be 40,000 ft. B. M. damage, which, figured at $5.00 per M. board measure, would be $200.00 damage.

Young Growth Intermixed with Merchantable Timber. Where a stand of young growth is mixed in with the merchantable growth

the value of the young timber killed should be figured, as well as the damage to merchantable growth, and reported under damage to "unmerchantable growth".

Damage to Unmerchantable Growth. As a basis for determining the value of young timber killed by fire, Table 2 will be used. To do so, four things must be known:

1. Number of acres of unmerchantable growth burned over
2. Average height of young trees killed
3. Percentage of the average acre that is fully reforested
4. Percentage of unmerchantable growth that is actually killed

Table No. 2

| Average Height feet | Damage per Acre $5.00 per M | $7.50 per M | $10.00 per M |
|---|---|---|---|
| 0-2 | .65 | $1.00 | $1.25 |
| 3-5 | 1.50 | 2.00 | 3.00 |
| 6-10 | 2.35 | 3.75 | 4.70 |
| 11-15 | 3.45 | 5.50 | 6.85 |
| 16-20 | 4.25 | 6.75 | 8.45 |
| 21-25 | 5.15 | 8.25 | 10.30 |
| 26-30 | 5.95 | 9.50 | 11.90 |

Example: A fire burned over 28 acres of young growth averaging about 10 ft. hight. The average acre was about one-third reforested and about one-half the young trees were actually killed. The local stumpage value is $5.00 per M. What is the damage?

Solution: (a) Young trees 10 feet in height come within the 6-10 feet class and the damage to a fully reforested acre of this class at $5.00 per M feet B. M. is $2.35. There were 28 acres burned so that the total damage would be $2.35 x 28 or $65.80, providing the area had been fully

stocked. (b) However, the average acre was about 1/3 reforested so that the damage would be $65.80 divided by 3 or $21.93, providing all the young trees had been killed. (c) But only one-half the trees on the average acre were killed so that the actual damage to the young growth was $21.93 divided by two or $10.97.

Damage to unmerchantable growth where trees are only damaged but not killed is not figured; but when there is a question as to whether young trees will survive or not they should be figured as killed. In case a few scattered trees over 10 inches in diameter are growing in with the unmerchantable growth the damage should be figured in board feet and shown under "Damage to Merchantable Growth."

Damage to Forest Products. This includes damage to saw logs, posts, poles, cross-ties, cordwood, etc. and the actual cash value at the point where burned should be shown and not the value at the market or shipping point. For instance the value of cordwood burned in the woods would be the stumpage value plus the cost of making the cordwood and not the value of the cordwood delivered in town.

Damage to Improvements. This includes damage to fences, houses, barns, telephone lines, bridges, tramways, railroads, etc. Damage should be figured on the value of the improvements at the time and place where destroyed or damaged and not on the basis of the cost of replacing such improvements.

Range and Pasture. The acreage of range and pasture burned over may sometimes be the entire acreage of the burned area; at other times, only a portion of the burned area suitable for grazing purposes should be figured as damaged at so much per acre. If there is a local value for grazing and pasturage, this should be used. If there is no well established local rate, a flat rate of ten cents per acre should be used.

The total fire damage is the sum of the various damages mentioned in the foregoing paragraphs, that is, damage to merchantable growth, to unmerchantable growth, to other forest products, to improvements and to range and pasture.

Estimating the Size of Burns. The size of a burn should not be guessed at. It is sufficient for all purposes to pace out the size of a burn. Size of the shape of a burn and decide about where the average length is; then pace this distance. Ordinarily, a man pacing with a slightly longer step than ordinarily will pace a yard. Decide about where the average width of the burn is and pace this distance. The size of the burn is the number of paces in the average length multiplied by the number of the paces in the average width, which will give the acreage in square yards. So, to find the number of acres in the burn, divide by 4840, the number of square yards in an acre

Example: How many acres in a burn 960 paces by 425 paces, figuring that a man paces a yard?

960
425
4800
1920
3840
4840/408000 square yards
84 acres (approximately)

Units of Land Measure

Acre - The unit of land measure in estimating land areas. Is approximately 209 feet or 69½ yds. on each side. It contains 43,560 square feet or 4,840 square yards.

Section - A tract of land one mile square (each side one mile long); it contains 640 acres.

Mile - Equals 5280 feet of 1760 yards

Vara - Spanish unit of land measure generally used in Texas. 1900.8 varas equals a mile; a vara is 33 1/3 inches long. 5645.4 square varas equals 1 acre.
To change varas to feet add 00 and divide by 36. To change feet to varas multiply by 36 and cut off the last two right-hand figures.

The most effective means of putting out a forest fire will depend on the character of the fire and of the country in which the forest fire occurs, and the tools to be used will depend on both the above factors and some others.

Grass Fires. Fires which occur on purely open grass lands or on lands largely in grass, but with scattering trees, are most easily controlled in their earlier stages by being whipped out. For this purpose fire swatters are a common

and efficient tool and a supply of these should be available on every project area. Also, Indian fire pumps are very efficient in fighting such fires, and a supply of these is recommended for each project. In the event a fire gets a good start before the work of putting it out is started, back-firing from a road, trail or other vantage point may have to be resorted to. In the event back-firing is done, it should be borne in mind that the back-fire should be started a sufficient distance ahead of the original fire so that the area burned over by the back-fire forms a real barrier to the spread of the original fire, and that the back-fire does not add to the intensity of the original fire. In some cases it may be necessary to cut out a lane of bare ground from which back-firing may successfully be accomplished. In this case a fire rake, such as the Council tool, will be found a useful tool. It must also be evident that all effective work must be done ahead of the fire, and then at the sides so that the fire is eventually "run to a point" and the control and extinguishment is eventually accomplished by this procedure.

An example of a forest fire report that is to be made by the project to the regional office follows.

Note:
1 - copy to Regional Forester
1 - copy to Project Office

## Forest Fire Report

1. Fire No. . . . . 2. Location (Project Area) . . . . . .

3. 1/4 Section, section, twp., range or other exact location . . . . . .

4. Time record — Date: AM PM

| | |
|---|---|
| a. Fire started . . . . . | |
| b. Fire discovered . . . . . | |
| c. Notified . . . . . | |
| d. Crew departed . . . . . | |
| e. Crew reached fire . . . . . | |
| f. Fire extinguished . . . . . | |

5. Area burned — Acres

| | |
|---|---|
| a. Merchantable growth . . . . . | |
| b. Unmerchantable growth . . . . . | |
| c. Open forest land . . . . . | |
| d. Non-forest land . . . . . | |
| e. Grassland . . . . . | |

6. Cause of fire (mark with x)

| | |
|---|---|
| a. Lighting . . . . . | |
| b. Railroad . . . . . | |
| c. Lumbering . . . . . | |
| d. Brush burning . . . . . | |
| e. Campers . . . . . | |
| f. Smokers . . . . . | |
| g. Incendiary . . . . . | |
| h. Miscellaneous . . . . . | |

7. Extinguished by (mark with x)

| | |
|---|---|
| a. Fire fighting . . . . . | |
| b. Rain . . . . . | |
| c. Burned out . . . . . | |

8. How learned of . . . . . .

9. Damage

| | Quantity damage (%) (% of stand injured, killed, etc) | Dollars | Cents |
|---|---|---|---|
| a. Merchantable growth | . . . . . | . . . . | . . . |
| b. Unmerchantable growth | . . . . . | . . . . | . . . |
| c. Wood products . . . . | . . . . . | . . . . | . . . |
| d. Other forest products | . . . . . | . . . . | . . . |
| e. Improvements . . . . . | . . . . . | . . . . | . . . |
| f. Range & pasture . . . | . . . . . | . . . . | . . . |

10. Value of extinction work

| | Number | Hours | Dollars | Cents |
|---|---|---|---|---|
| a. Crew . . . . . | . . . . | . . . . | . . . . | . . . . |
| b. Foreman . . . . . | . . . . | . . . . | . . . . | . . . . |
| c. Volunteers . . . . . | . . . . | . . . . | . . . . | . . . . |
| d. R. R. employees . . . . . | . . . . | . . . . | . . . . | . . . . |
| e. Use of private equipment | . . . . | . . . . | . . . . | . . . . |

11. Date . . . . . 12. Signature . . . . . .

13. Title . . . . . .

14. Important: All fire data must be obtained by personal investigation.

## Forest Fire Protection Plan

A well-rounded forest fire protection plan for the project areas should include the following:

1. At least two organized crews of eight men each, who shall be available at all times for fighting forest fires in case such fires occur. There should be oneman on the job responsible for the extinguishing of forest fires, preferably a man familiar with the area, and each crew should be in charge of a foreman. In the event of unusually large fires the size of the crews may be increased from other men available on the job.
2. Tools should be available for use of the fire crews at a point easily accessible to the crews. As an ideal set-up for each crew of eight men the following tools are suggested:

6 - Council tools
2 - Asphalt rakes
1 - 5 gal. Indian fire pump
1 - one-burner gasoline lantern
1 - 5 gal. water bag
1 - Double-bitted axe
1 - Cross-cut saw
Files

In the event of grass fires "fire flaps" are found very effective. Such fire flaps are commonly made from pieces of old saw-mill belting about 12" wide and 18" to 20" long. This belting is inserted in a slot sawed in an old rake or shovel handle and the belting is fastened in the slot with a couple of stove bolts. Rubber flaps on a special handle

may be purchased at a reasonable cost. As a means of replenishing the Indian fire pumps a galvanized iron tank of from 100 to 150 gal. capacity will be found advisable, and in the absence of such tank, drums or barrels will serve.

3. For the early detection of forest fires a fire tower of sufficient elevation to clear the surrounding timber and ridges is in most cases an essential feature. A steel fire tower of 100' height has been recommended for most areas, which, from the location selected, it is felt will overlook the entire area in each case. A tower of this sort will have a range of from 10 to 20 miles depending on the visibility. It should be connected with the project headquarters by telephone, so that the fire-fighting crews may have immediate notification of the discovery of a fire and its correct location. A look-out man should be on the tower from about 10:00 A. M. until sundown. This lookout man should be thoroughly familiar with the surrounding country so that the exact location of the fire may be determined as nearly as possible. In the event other towers are located in the region cross-shots may be made to get the exact location of the fire.

4. For effective forest fire fighting rapid transportation for the fire crews and tools to the scene of the fire is essential. Any forest fire is more easily controlled in its early stages, and it is distinctly desirable to confine the fire to the smallest possible area.

5. To reach areas in timbered sections difficult of access at present for trucks, truck trails may be necessary when the present roads do not suffice. Such truck trails will also act as fire breaks and aid in confining the fires to small areas.

6. Fire breaks may be needed in addition to roads and truck trails in confining forest fires to small areas and in preventing forest fires from encroaching on the project area. Such fire breaks are in most cases indicated along the exterior boundaries, where natural barriers, such as roads, rock escarpment or other barriers, would not ordinarily prevent the spread of forest fires. It is felt that a fire break consisting of two ploughed furrows 15 feet apart, between which the ground has been cleared of all grass, brush, dead and down material and other litter, will ordinarily be effective in preventing the spread of ground fires. Interior fire breaks in the area are in some cases advisable where the system of roads and truck trails does not suffice.

7. A system of reporting forest fires - the date and hour of their occurrence, by whom discovered, probable cause, duration and extent (area burned over), amount and value of forest growth destroyed - should be put into effect and required in the case of all fires that occur on the project areas, whether extinguished by the regular fire-fighting crews or otherwise. Such statistical information is valuable in planning future fire protective work, since it

indicates the location in which fires most frequently occur, the most prevalent causes of forest fires and other important details.

8. Every effort should be made to educate dwellers in and near the project areas as to the destructive features of forest fires and the futility of such fires to bring about any real benefit. Also, casual users of the project areas should be made aware of the destructiveness of forest fires and warned against carelessness along these lines.

## FIRE FIGHTING TOOLS AND EQUIPMENT

The experience of the U. S. Forest Service and the various state agencies concerned with the control of forest fires has shown certain tools and equipment to be especially effective or necessary. For this region such tools and equipment are listed below:

1. Indian fire pumps
2. Council tools. A sort of rake with teeth like a mower blade, which can be used for either raking or cutting
3. Asphalt (or road) rakes. Heavy rake with a long metal shaft
4. Fire flaps
5. Flame guns
6. Cross-cut saws
7. Tanks and buckets for handling water
8. Double-bitted axes
9. Canteens or water bags
10. Files

Of course, it is presupposed that transportation has been provided and will be available for transporting men and tools in case of fire. Rapid transportation to such fires as are discovered is essential if the fires are to be confined to the smallest possible area. If possible, during the season when forest fires are likely to occur, a truck should be kept handy to some control point from which men and tools may be dispatched to the point where the fire has been discovered.

Note: The Indian fire pumps are put out by the D. B. Smith Co., 405 Main Street, Utica, New York. The Council tools are manufactured by the Council Tool Co., Wananish, North Carolina, and satisfactory flame guns are put out by several firms, two of which are the Hauck Manufacturing Co., 125-134 Tenth Street, Brooklyn, New York, and the Aeroil Burner Co., Inc., 178 North Wacker Drive, West New York, New Jersey. The balance of the fire tools and equipment listed is generally purchasable.

## FIRE BREAKS

By a fire break is meant any physical feature which will stop or check a forest fire. A fire break may be a road, a trail or a rocky escarpment. Such fire breaks are more or less incidental features of which advantage should be taken in fire fighting operations. Other fire breaks are planned with the idea of preventing the spread of forest or grass fires, confining such fires to limited areas and offering vantage points from which fires may be fought.

Planned fire breaks are ordinarily strips through an area, cleared of trees, brush, leaves and inflammable litter of whatever sort. These cleared strips to be effective should usually be about from 15' to 50' wide, and their location will be determined by a study of the existing fire hazards. The exterior boundaries of a project area suggests themselves as especially hazardous situations. Also, certain activities within the project areas suggest themselves as creating a fire hazard, such as much-frequented recreational areas. In such situations the need of fire breaks suggests itself, and the advisability of their construction should be studied.

It is well to plan fire breaks on a map and then check the plan by a study of conditions in the field. It is distinctly inadvisable to spend money building fire breaks if they are not going to serve a real need.

It is essential that after the original construction, firebreaks be kept in a condition of usefulness. This means that at least once annually the cleaning up process will have to be repeated, and this should be done preferably just prior to the usual fire season.

In some situations it may be advisable to plow a strip on one or both sides of the cleared strip, but the plowing should be done with the contour of the land so that no erosion problem is started.

FIRE HAZARD REDUCTION

In order to define and standardize the work which is being done and will be done under the above heading, the following points are set forth.

1. Fire hazard reduction is the removal from definite areas of inflammable material in which a forest fire may be easily started, or which will materially aid in spreading forest fires already started. Such inflammable material is ordinarily dead trees or logs on the ground, standing dead trees and snags, brush and slash resulting from cuttings or clearings, litter and debris of every sort, including dead leaves.

2. Fire hazard reduction operations are advisable in the following situations:

   a. Along roads, truck trails and foot trails, where travel is frequent, for the reason that a carelessly flung match or cigarette butt may easily start a fire. Also, along much-traveled roads or trails a large amount of litter or debris is a temptation to thoughtless or maliciously-minded persons to set a fire. Further, fires set by individuals or parties for warming or cooking purposes are usually set close to a road or trail, and too often are not extinguished completely when their purpose has been served.

   b. On recreational areas much frequented by picnickers or campers where fires are set for various purposes.

c. Adjacent to and in the neighborhood of improvements which might be endangered by a forest fire.

d. It is sufficient under ordinary conditions in fire hazard reduction operations to clear a strip on either side of the road or trail fifty feet (50 ft.) wide. Under unusual conditions a wider strip may be advisable. From this fifty foot strip all inflammable material should be removed and disposed of by burning in the trail or road or in some space where the least damage will be done to standing timber. Dead snags and dead standing trees should be cut down as close to the ground surface as possible and disposed of, since a fire will burn in standing snags or dead timber for a long time and throw sparks for long distances if the wind is high. It is desirable that the piles of materials to be burned should be as small as consistently possible and should be watched and kept raked together until they are practically burnt out. In dry times and seasons it is usually inadvisable to build fires after noon, because they cannot be watched and tended until they are beyond a dangerous stage. Before leaving burning or smoldering brush heaps, they should be raked around and made as safe as possible.

3. On recreational and picnic areas the clean-up and burning will usually cover all the area ordinarily used for such

purposes. In the neighborhood of buildings and other improvements the clean-up and burning will be governed somewhat by the character of the structure; that is whether it is built of wood or of stone or brick. It is usually sufficient to clean up an area 100 feet wide all around the structure. In some cases the clean-up and reduction of fire hazard is influenced by the contents of the building. For example, it might be necessary to clean-up a considerable area around a building in which gasoline and oil were stored, or a house or building used for the storage of powder or dynamite.

4. Fire hazard reduction is a species of house cleaning. It is work that will have to be repeated annually to be effective, but the cost of the second and subsequent operations should be materially less than that of the first.

## STORAGE HOUSES

1. For Fire Fighting Tools and Equipment

Such storage houses do not of necessity have to be large. Under most conditions a building 8' x 8' is of sufficient size for the purpose. Such buildings should have preferably a concrete floor, although a well-compacted floor of gravel of good depth would serve. These buildings should be thoroughly well constructed so that they cannot be broken into easily. Windows are not a necessity, and may be omitted, nor is ventilation an important feature.

2. For Seed

Such storage houses, if constructed, should be of larger size than those described above. The size will depend on the amount of seed which will probably be gathered. Properly to care for the seed, the storage houses should be rodent proof and should have a large amount of ventilation so that the seeds will stay as cool and dry as possible. Seeds overheat and lose their germinating ability if not kept as cool and dry as possible. Racks should be provided so that the seed may be spread out as much as possible and aeration provided for within the buildings.

FOREST FIRE LOOKOUT TOWERS

The early discovery of a forest or grass fire is one of the essential features of a fire control plan. Steel lookout towers equipped with telephone connection to some central point from which men and fire-fighting equipment may be dispatched to the seat of the fire have proven most effective in this connection.

In the specifications for these towers the standard specifications of the Forest Service, U. S. Department of Agriculture, should be followed. These specifications are fully set forth in the set of mimeographed copies of "Specifications for Steel Lookout Towers, 7' x 7' cab type", with drawings T-1001 A to F 1012A inclusive, published in September 1936 and in drawings B-7501-A, B-7502-A, B-7504-A, B-7506-A and B-7510-A as revised October 9, 1934. Copies of these plans and specifications have been furnished to each Project Manager.

There is only one change suggested in these plans and specifications, and this is in connection with the drawing for a typical concrete pier of Drawing T-1008, Foundation Layout, Sheet 8. It is suggested that the "Typical Concrete Pier", as shown on this sheet, be changed by widening the base of the pier at a point 3' from the base, and by increasing this so that the bottom of the pier where it joins the base is 2' wide and not 1'4". Of course, the height of the towers will vary with the field conditions encountered on any project, and such modifications of the specifications from the type, 100' tower with 7' x 7' cab, as the height of the tower indicates, will necessarily have to be made. Towers with inside stair-

ways should be considered standard.

Since it has been shown that these lookout towers are annually visited by tourists and others in considerable numbers, it is felt that the type of tower with inside stairway is altogether the most satisfactory. In this connection it may be mentioned that one tower in Michigan records 350 visitors within a six months period. Towers of the Texas Forest Service, also, have large numbers of visitors. One 100' tower near Jacksonville, Texas registered 1380 visitors from August 19 to September 23, 1936. Even towers far from the main traveled highways have many visitors for the view they afford. From this it appears that the recreational feature of fire lookout towers cannot be overlooked. The fact that these towers are accurately located has made them of great value in topographic mapping and aerial photography.

TELEPHONE CONSTRUCTION

1. Rights-of-way. The first step in telephone construction is to determine the approximate route which the line will follow and then secure the necessary agreements or easements for fights-of-way. If the line is to be built for any distance along county roads or state highways, written permission should be obtained from the proper county authorities, or from the Division Engineer in case of a state highway. If the line will cross privately-owned land, a written agreement should be obtained from the owner of the land for the construction of the line. If the line is on land purchased by the Resettlement Administration, no right-of-way agreement is, of course, necessary; but if the land is only under option, and purchase has not as yet been complete, the permission of the actual owner of the land for the construction of the line should be obtained in writing. If the land is owned by the government, but is not controlled by the Resettlement Administration, permission of the agency under whose jurisdiction the land actually is should be obtained in writing for the construction of the line. Unless there are strong reasons for a greater width, a right-of-way of 10 feet is sufficient.

2. Staking and Clearing Rights-of-way. Thirty-five poles per mile will be standard construction, so that the poles will be about 150 feet apart. The telephone line should be staked out on this basis over the route which it is to follow as a preliminary step in clearing the right-of-way. This work will ordinarily be done by a surveyor. The

right-of-way will then be cleared. All trees should be cut down flush with the ground, and all brush cut off level with the ground.

3. Brush Burning. The brush and debris resulting from clearing should be piled in some open place, such as a road right-of-way, and burned. The burning should keep pace asfar as possible with the clearing. It will be found inadvisable in dry seasons to set piles of brush on fire after noon, since they cannot usually be watched for a sufficient length of time to make certain that they are beyond the dangerous stage. All burning brush piles should be raked around and made safe before leaving for the night.

4. Line Specifications. For all practical purposes a ground circuit line is all that is needed on the project areas. However, if serious interference is anticipated from a high voltage power line or from any other cause, a metallic circuit may be necessary, but in this case the burden of proof will be on the project manager to show that a metallic circuit is needed. Poles will be 16 feet creosoted poles with $3\frac{1}{2}$" to 4" top and roofed. Creosoted shortleaf or loblolly poles are adequate for every purpose. They should be set in the ground three feet. When creosoted telephone poles are received in the project area, they should be stacked in piles away from all activities likely to start fires, since creosoted poles are highly inflammable. These individual piles should be at least 50 feet apart. The wire for the grounded circuit lines

will be #9-B. W. gauge galvanized iron wire, diameter 0.148 inch. The brackets should be the regular wood brackets, and the insulators, glass insulators.

5. Line Construction. Where the line is straight the poles should be set 35 to the mile, or approximately 150 feet apart, but on curves, at corners, or at line terminal span lengths should be as follows:

| Amount of Pull | Span Length |
|---|---|
| 5 - 15 feet | 125 feet |
| 15 - 20 feet | 120 feet |
| 20 - 25 feet | 115 feet |
| 25 - feet and over | 100 feet |

a. Holes should be dug three feet in depth and of sufficient size, so that the poles will go in easily and allow for tamping and filling. After the pole is set in the hole, fill and tamp, using preferably one shoveler to three tampers, who shall work continuously until the hole is filled.

b. Raking. Poles on curves or at corners should be raked; that is, set at an angle so that the pull of the wire is off-set by the rake of the pole. Where pull is less than 5' the rake should be about 10"; for a 5-10 pull the rake should be about 25". When poles are raked a large rock should be placed in the ground against the pole about one foot below ground level on the inside of the curve. In the absence of a suitable rock a log or post of oak, red cedar or similar decay-resisting species may be used.

c. Trucks should be used to distribute the poles to the places staked out for the location of the poles. Insulators and brackets should be placed on the poles before they are put in the ground. It will be sufficient to nail the brackets to the poles and wrap two or three wraps ofwire around the lower end of the bracket. The brackets should be placed close to the top of the pole, so that the line when strung will be about even with the top of the pole.

d. Poles, if along roads or highways, should be set with brackets on the side away from the road, except on curves where they should be on the outside against the pull of the wire. The roof of the poles should be at right angles with the direction of the line, so that water does not drip on the brackets. A small mound of earth should be thrown up and packed around the base of the poles to a height of about 12" as a protection to the poles in case of ground or grass fire.

e. The wire should be strung out by means of a regulation wire reel on a truck and attached to the insulators by using five laps of wire on each side of the insulator. If the line is built in hot weather, a sag should be allowed for contraction in cold weather. The sag will be about as follows for a 150' span:

100 F° - 21"
80 F° - 17"
60 F° - 13"
40 F° - 11"
20 F° - 9"

f. On every tenth pole lightning arrestors should be placed. These should consist of two strands of #9 gauge wire attached to the pole by staples and with a coil of wire buried in the ground at the base of the pole. The lightning arrestors should be so placed that they do not come into contact with the telephone line itself, and a short loop or wire should project about three inches or four inches above the top of the pole.

g. All splices should have no less than seven wraps on each side of the splice and should be soldered to avoid any chance of a loose connection. The single tube type sleeve is recommended for all splices in place of soldering. This character of splice is especially recommended where more or less inexperienced labor is used.

h. In crossing roads or highways it is necessary that there be a clearance of 20 feet at the lowest point of the wire. This means that at least 25 foot poles should be used on either side of the highway and should be set four feet in the ground. If it is necessary to cross a railroad, pipe-line or power line, special permission will be necessary for the crossing, and an underground conduit should be installed. For this purpose a #14 copper insulated wire encased in lead and further encased in a 3/4" galvanized iron pipe should be used. In asking permission for such crossing, the exact location with relation to a mile post, numbered pole or some de-

finitely fixed object will be necessary, together with a map showing the location.

6. After the poles are up and the line in place a crew should be sent back over the line to see that there are no limbs of trees touching the line, and to trim away any limbs that are likely to touch the line within the next year or two. All limbs of any size should be trimmed close to the tree, so that unsightly stubs are not left through which decay might enter the tree.

7. When installation of a telephone is to be made in a look-out tower, a pole should be set about five feet from the base of the tower, and the line brought to this pole, for the necessary connection with the tower installation. The details of tower or building installation will be furnished on request.

8. The telephones suitable for use on the projects are:

a. Wall telephone, #2884 F. S. type; Kellogg Switchboard and Supply Co.

b. Portable desk telephone, #90-A, Desk Stand, including #41 receiver and #2415 desk-set box; Kellogg Switchboard and Supply Co.

c. Wall telephone, #1317-S, Western Electric Co.

d. Portable desk telephone set, #6004-B, desk set, including #1020-AL desk set box, #143-AW receiver, #323 transmitter; Western Electric Co.

9. The following tools, supplies and materials are suggested as needed in line construction:

Poles - creosoted, shortleaf or loblolly pine 5" top, 18" long
Wire - #9, B. W. Gauge galvanized iron
Shovels - long-handled, pointed
Axes - double-bitted
Brush hooks
Cross-cut saws
Brackets, wood
Insulators, glass
Splicing clamps (connectors)
Pliers, side-cutting 8"
Ladder, 12' taper
Sleeves - single tube type) or (Solder, acid case soldering
Sleeve twisters ) or (iron blow torch
Hammers
Spikes
Staples
Type
Wire reel
Diggers, post hole
Tamping bars
Root cutters

10. The cost of construction should not ordinarily be in excess of $200.00 per mile.

11. The regional office will be glad to supply additional information along this line upon request, especially with regard to proper installation in look-out towers, buildings, etc.

## FOREST STAND IMPROVEMENT

Forest stand improvement does not involve forest planting and seeding, which are considered under a separate heading and conducted as a distinct and separate operation. Forest stand improvement, as usually considered, involves those operations with the existing forest cover, which tend to improve its condition and composition by the removal of undesirable species, malformed and worthless individuals and dead timber; by thinning and pruning where needed and advisable and by other such like operations.

Measures looking to stand improvement should have a very definite object in view, and what that object is will depend on circumstances. In some cases it may be the use of the area for recreational purposes; in other cases, the furnishing of shelter and food for wildlife; and in others, the production of timber or other forest products, or it may combine any or all of these objects. In any event the value of the forest cover as a means of preventing erosion and retarding surface run-off should be kept constantly in mind.

Since on all projects the present forest cover is inadequate and is decidedly valuable for the purpose it serves in retarding the surface run-off, preventing erosion, and furnishing a home and food for wildlife, any measures taken to improve the composition and character of the stand should be undertaken slowly and proceed circumspectly so that no serious and unfortunate conditions result from work done to bring about stand improvement. The following points should

be strictly observed.

1. Dead trees should be cut down and the stumps should be cut low so that their disintegration may be as rapid as possible. Dead trees that are felled should be lopped of all limbs so that the trunks lie close to the ground and the dead branches scattered so that they too lie close to the ground. In this way the rotting of this dead material is hastened.

2. No live trees should be cut unless they are marked for cutting.

3. Mal-formed trees should be cut only when the resulting break in the forest cover does not increase an already too large open place in the stand.

4. If live trees are cut the branches should be lopped from the trunk so that the trunk is in contact with the ground, and the branches themselves further lopped and scattered over the ground so that decay is as rapid as possible. In this way the forest litter and humus is increased and the danger from forest fires resulting from thr work greatly reduced. Surface run-off is also somewhat retarded.

5. No underbursh should be cut at the present time except under the specific orders of he man in charge of the work to accomplish certain definite results, since for the most part the forest cover on the project areas at

present is much too scant. It must be borne in mind also that the brush in large measure furnishes food and shelter for wildlife.

6. No removal of undesirable species should be attempted unless it is proposed to replant with desirable species within a relatively short time, and such removal of undesirable species should only be done at sufficiently widely spaced intervals so that the operation does not open up the forest cover to a dangerous extent.

7. Under ordinary circumstances the disposal of brush resulting from improvement cutting will be by lopping and scattering, except along park roads or in other situations where the lopping and scattering of brush would result in an unusual fire hazard (as in the proximity of a picnic area) or would result in an unsightly mess on or near areas commonly used and seen by the general public. In such situations the brush should be piled in open places (such as road-way or an opening of some size in the forest cover), and burned. In burning brush, however, every care should be exercised to prevent the fire from spreading and from doing damage to adjacent, standing timber. The ground around the piles should be raked and a continued watch kept to see that the fires do not get out of bounds. The piles should be relatively small and kept raked together.

8. In considering desirable species to be left the following principles will govern in the main:

a. In the upland type of forest the desirable species are post oak, black jack, oak, hickory and red cedar.

b. In the lowland type of forest the species to be favored are the oaks, black walnut, hickory, red cedar, sycamore, mulberry, osage orange, Kentucky coffee tree, red elm, ash and in certain situations black locust, honey locust, cottonwood and willow.

c. In general red-bud, dog-wood, service-berry and the haws should be retained, if found, for their attractive flowering habits and the charm they add to the landscape as a whole. This applies also to such trees as holly, if any is found, for the reason that this tree enhances the winter landscape by its evergreen leaves and conspicious red berries.

9. Another matter to be considered in connection with forest stand improvement operations is whether the material removed from the stand has any commercial value in the form of cord-wood, posts, ties, logs or any other products. If the material resulting from stand improvement operations has a real commercial value, a study should be made of the market with a view to the profitable disposal of the possible forest products. This might well be a considerable factor in liquidating the project cost.

10. The stumps of all trees cut in stand improvement work should be cut low - not over 12 inches in height, and lower if possible.

11. Some modification of these instructions may be necessary to furnish food and cover for wildlife.

a. Occasional dead or hollow trees may be left standing.

b. Occasional brush thickets may be left uncut.

c. Piles of brush about 1000 yards apart may be made over an old log or in such a manner as to form a refuge for wildlife.

d. Certain species, valuable because they furnish food for wildlife, may be left in the stand improvement operations

Market for Products: In connection with forest stand improvement operations, it may be possible to manufacture various forest products which are desired for use in the development of the project area. These products will usually be cord wood, posts or construction timber. A study should be made of the local market to see if there is any possible sale for such products as may be made and the price. A steady market for posts, or cordwood, for example, may go a long way in actually paying for the stand improvement work. This phase of stand improvement work deserves careful consideration.

Cost Data. Another phase of the stand improvement work of which careful record should be kept is the cost of the operation. Such data is very valuable in planning additional work of this character in the area involved, and also on other

project areas which may be under consideration or approval. The cost data should show clearly the various phases of the work, such a s

a. Preliminary work; locating corners and property lines, stripping the area, etc.

b. Actual stand improvement work

c. Manufacture of forest products, such as posts, cordwood, etc. if any forest products are manufactured. This last is important in determining the market value of the forest products manufactured.

## Trees Commonly Found in the Region

Some of the more common tree leaves and seeds found in this region are illustrated in the following pages, along with a brief description indicating where adapted and their common uses. Most of these illustrations are taken from those appearing in Publication No. 1, Forest Trees of Oklahoma, Oklahoma Forest Commission.

### Common Trees or Shrubs Which Furnish Food for Wildlife

| | |
|---|---|
| Oaks | Red Cedar |
| Hackberry | Walnut |
| Black Locust | Honey Locust |
| Mulberry | Redbud |
| Service Berry | Holly |
| Hawthorn | Wild Plum |
| Sumac | Persimmon |
| Sassafras | Dogwood |

### Common Lowland Trees

| | |
|---|---|
| Black Walnut | Pecan |
| Black Locust | Ash |
| Honey Locust | Osage Orange |
| Sycamore | Red Cedar |
| Red Elm | Loblolly Pine |
| Kentucky Coffee Tree | Burr Oak |
| Mulberry | Hackberry |

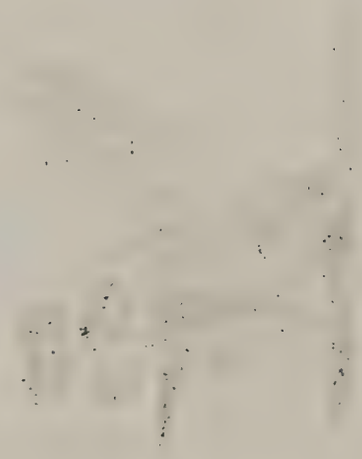
### Common Upland Trees

Post Oak
Black Jack Oak
Hickory
Red Cedar
Red Oak
Hackberry

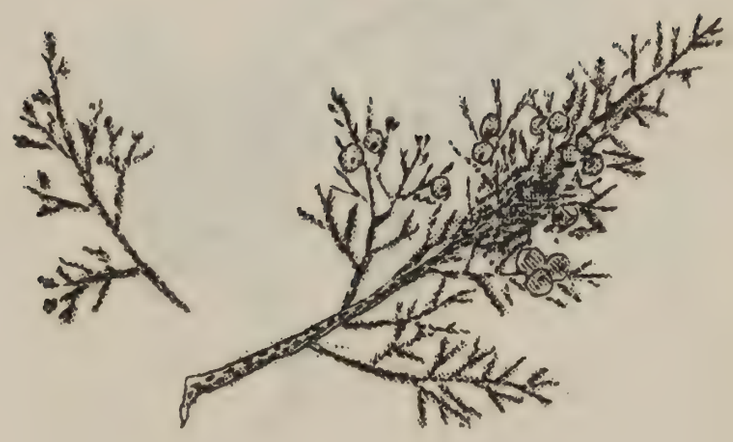
# SERVICE BERRY

The service tree is found largely in the northeastern part of this region where it is locally known as "sarvis". It is a small tree, from 20 to 50 feet high and from 6 to 16 inches in diameter, often being little more than a shrub, growing largely on the mountain slopes.

The wood is hard, close-grained, strong and brown in color. The tree is desirable for its benefit to wildlife.

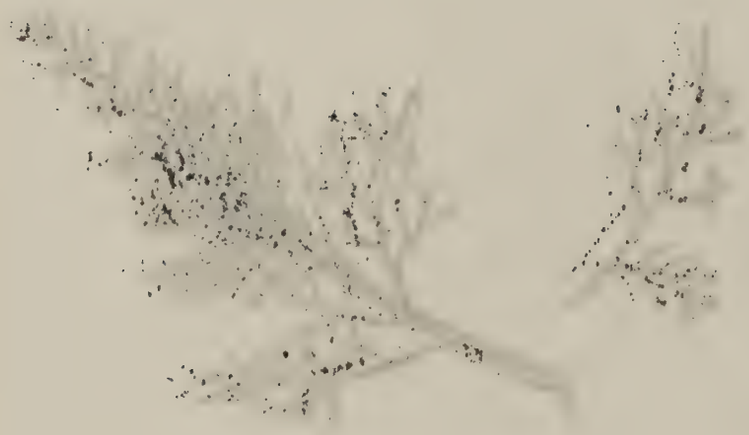


# RED CEDAR

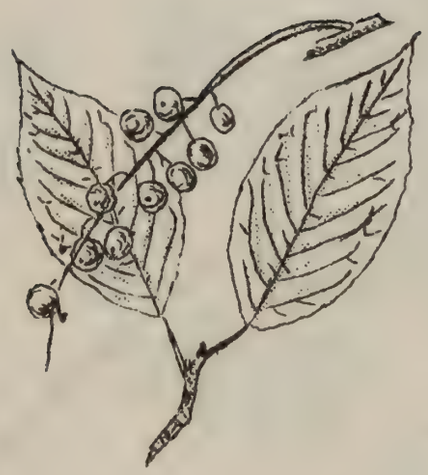


Red cedar is a valuable tree capable of growing under a wide range of conditions, from swamp to dry, rocky ridges. Red cedar is well adapted to barren soils, where few other trees are found. Its seed or berries are recognized as one of the favorite winter foods for birds, and in the southwestern part of the region the leaves are said to furnish winter feed for deer.

The heartwood is red, and the sapwood, white, giving striking effects when used for makihg cedar chests, closets, doors, etc. The wood is strong and durable, even in soil, making it very desirable for posts.



# BLACK CHERRY



Black cherries grow best in the hills of the eastern part of the region. The trees are medium in size, growing up to about 70 feet high, and from one to three feet in diameter.

The wood is very much in demand, due to its hard, strong, fine-grained texture. It is of a reddish brown color with yellowish sapwood. It does not readily warp or split in seasoning. Black cherry takes a luster in polishing, and, therefore, is very valuable for furniture, interior finish, tools, and implement handles. The fruit is a valuable bird food.

# COFFEE TREE

This tree is a legume that is well adapted for planting in the open and poorer soils.

It has value as an ornamental tree and is used in places for posts or poles in general construction, as the wood is durable when in contact with the soil.

# CAROLINA POPLAR

(COTTON WOOD)

Cottonwood trees grow along streams or in low sub-irrigated areas over the entire region. As it grows readily from cuttings, it is easily propagated, after which it makes a most rapid growth. The wood is soft, warps easily, but is used in frames for outbuildings, veneering, and for making high gloss magazine paper

# DOGWOOD

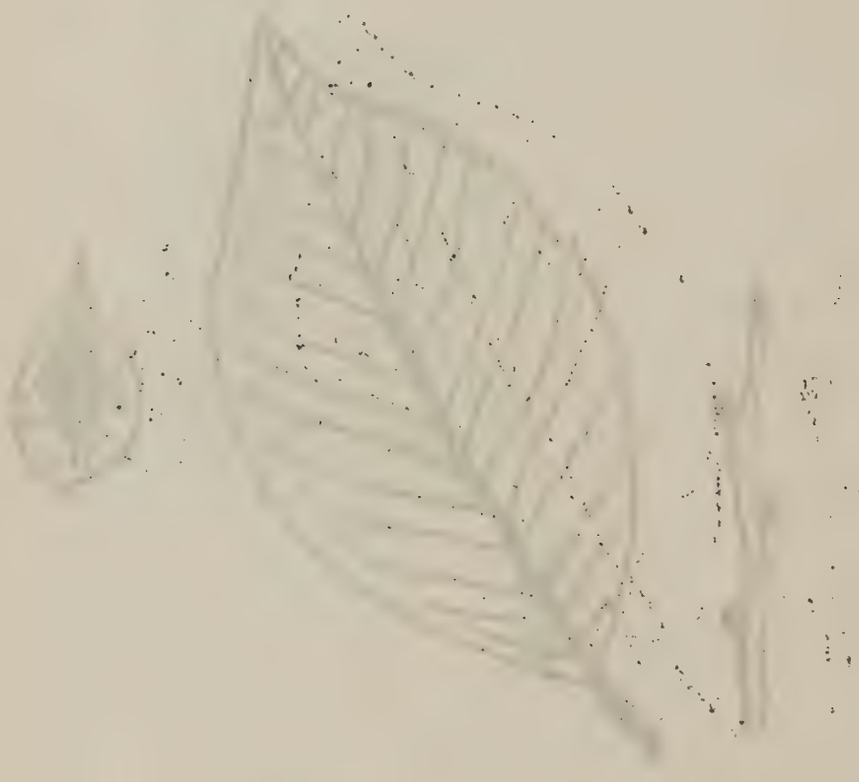
This shrub grows over much of the eastern side of this region. It generally is from 10 to 30 feet high with a rather crooked trunk, which sometimes is over six inches in diameter. It is usually found among other trees. It is used largely as an ornamental tree because of its showy spring flowers and bright red berries.

The wood is hard, heavy, close-grained and strong, being in demand for cotton mill machinery, turnery handles and forms.

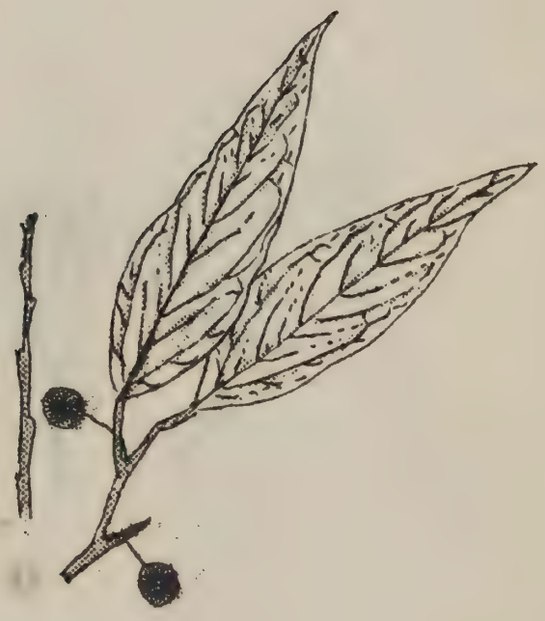
# RED ELM

This tree is commonly found in the eastern part of this region along banks of streams or on low hillsides in rich soil. It is often referred to as slippery elm. The trees do not grow to a large size, but are spreading in habit.

It has a variety of uses, the wood being hard, heavy, strong, tough and fairly durable. Fence posts, crossties, agricultural implements, and ribs for small boats are some of the uses to which this wood is put.

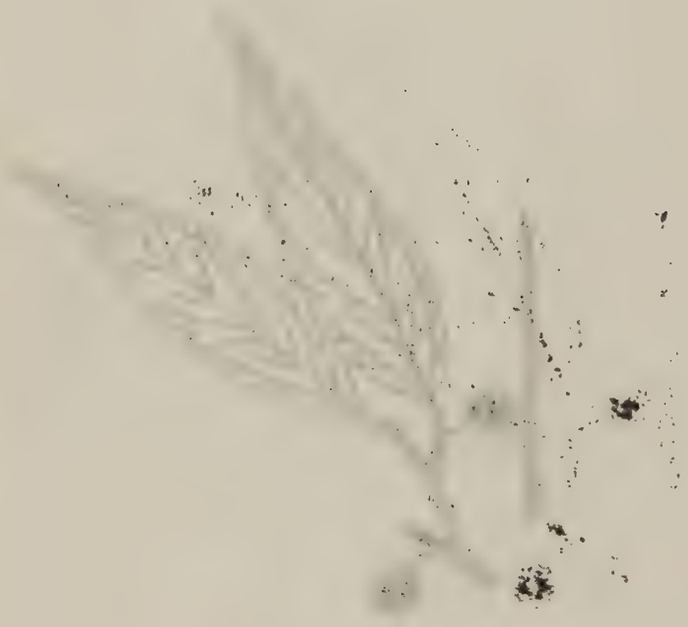


# SOUTHERN HACKBERRY



This tree is grown very easily in the eastern part of Texas and Oklahoma, where it grows to great size along the rich fertile lowlands. It will, however, grow on soil from the richest to the poorest. Usually it grows from 30 to 50 feet high, and is often a good shade tree where other varieties are not adapted.

The wood is soft and weak, but is sometimes used for flooring or furniture making. The sweet berries or fruits are very palatable to wild birds and animals.

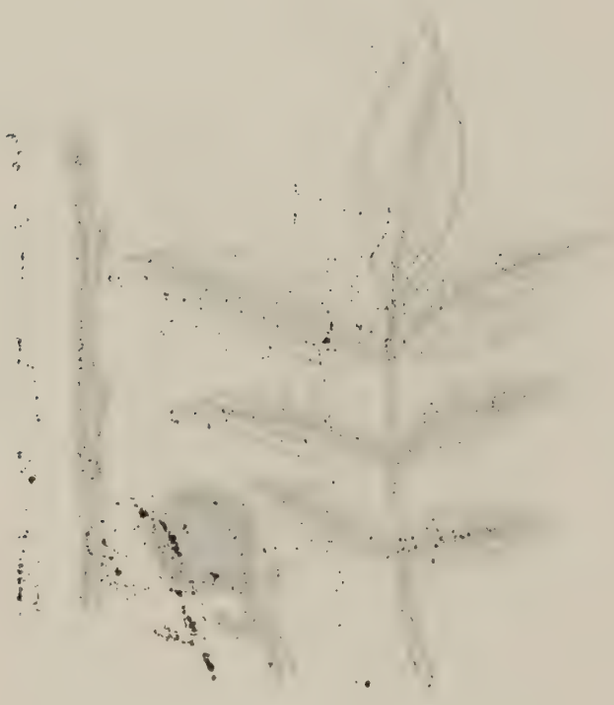


# HAWTHORN

There are a number of species of this tree, which are commonly known as haw, white haw, red haw, and thorn bush. They grow on nearly all types of soil. Outside of furnishing food for wildlife and being ornamental when flowering or when the fruits ripen, they are rarely used for any purpose.

# BLACK HICKORY

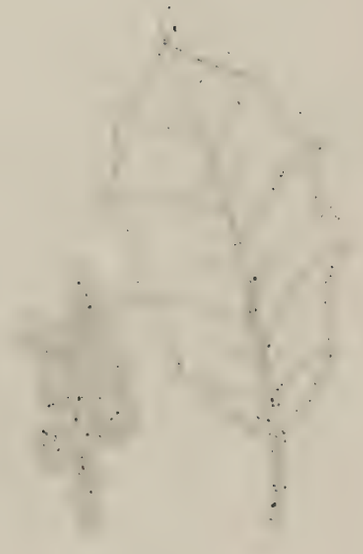
The black hickory is the most common variety found in the eastern part of this region. It grows on rocky hills or on sandy upland. Often the tree is two feet in diameter and reaches a height of 60 or more feet. The white hickory is tough and strong, and is used for vehicle parts, handles, etc., while the wood of the black hickory is brittle and hard, only making good fuel. Both trees make good shade.



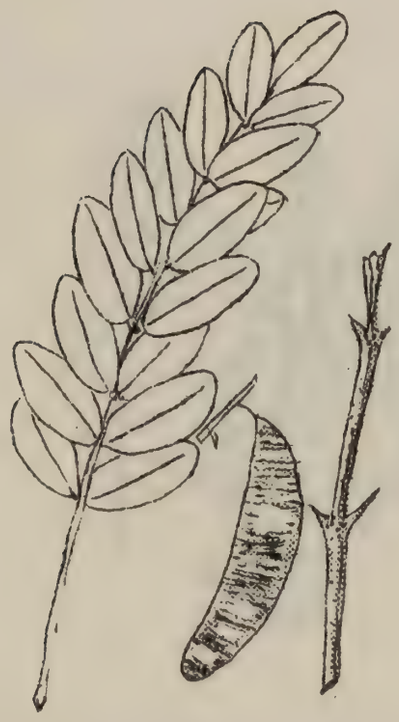
# HOLLY

Holly is found in the eastern part of the region, where it grows mostly on moist, rich soil, but it is also found on higher and drier locations. It is an evergreen tree, seldom exceeding 30 or 40 feet in height and 12 inches in diameter.

The wood is light, but tough, although not strong, and is nearly white. It is valued and used for cabinet work, and the berries supply winter food to birds.



# BLACK LOCUST



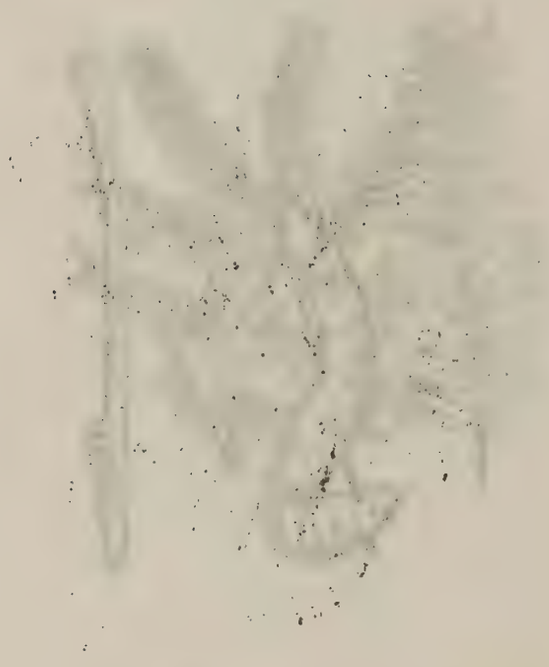
Black locust trees are grown over the entire region. They grow well on upland and poor soils where many other kinds of trees will not grow. Because of their good root system and excellent feeding qualities, they are able to maintain themselves during severe drought periods. However, in some places they are badly attacked by the locust borers.

Locust wood is coarse grained, heavy, hard, strong, and very durable in contact with soil. It is used extensively for fence posts, poles, insulator pins, and occasionally for lumber and fuel.

# HONEY LOCUST

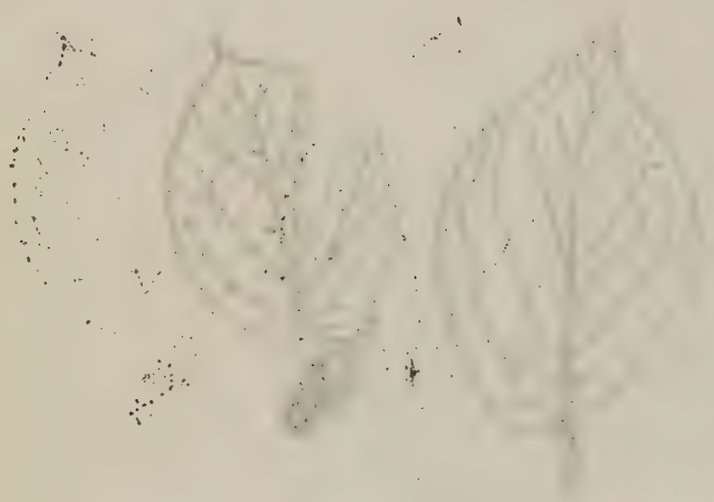
Honey locust grows on a great variety of soils under wide moisture conditions. Under very favorable circumstances it grows to be a good sized tree. Its long short thorns and feather-like pinnate leaves serve to readily identify it.

It is a coarse grained wood that is hard, strong and moderately durable in contact with the ground. It is used for fence posts and cross-ties. The tree is planted in gullies for controlling soil erosion.



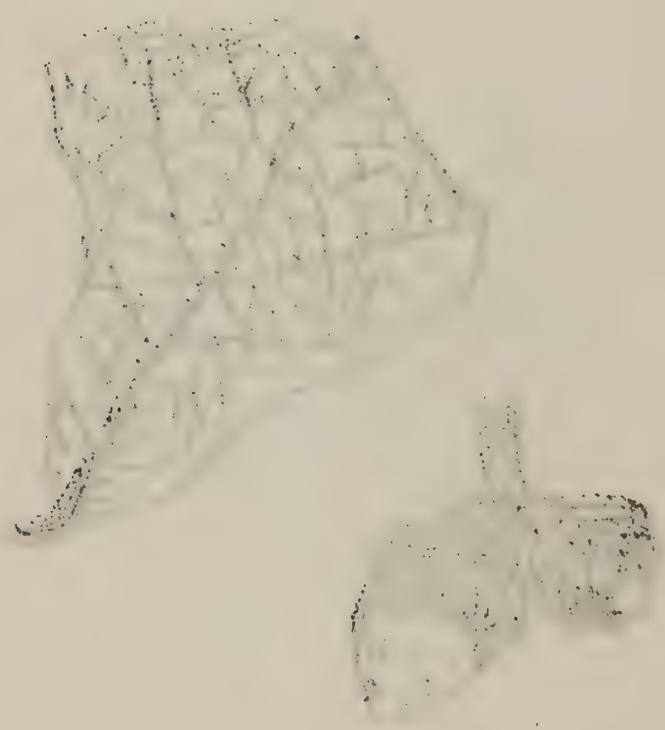
# RED MULBERRY

The mulberry is best grown on fairly rich soils. It is a small tree often found in the shade of other trees. The wood is light and not very strong, but very durable, and is used for fence posts, as it is easily grown. The berries are desirable for food for birds.

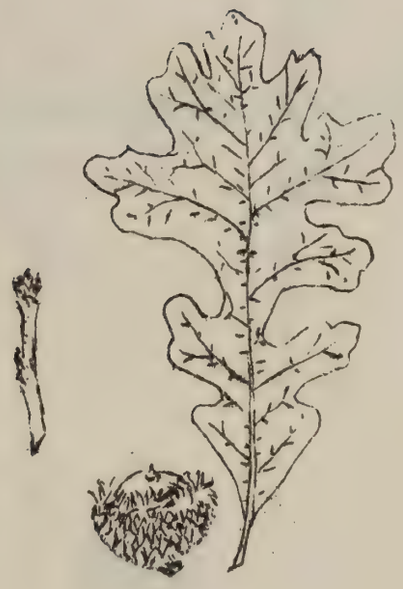


# BLACKJACK OAK

This tree grows on dry or sandy land, very well, but may be found on all types of poor soil from poorly drained clay to gravelly soils, and over most of this region. It has little value except for firewood. Black jack sprouts are hard to eradicate after clearing, which is very expensive once the trees become well established. These trees have become well established in certain sections and occupy space that would be more valuable if in pasture.



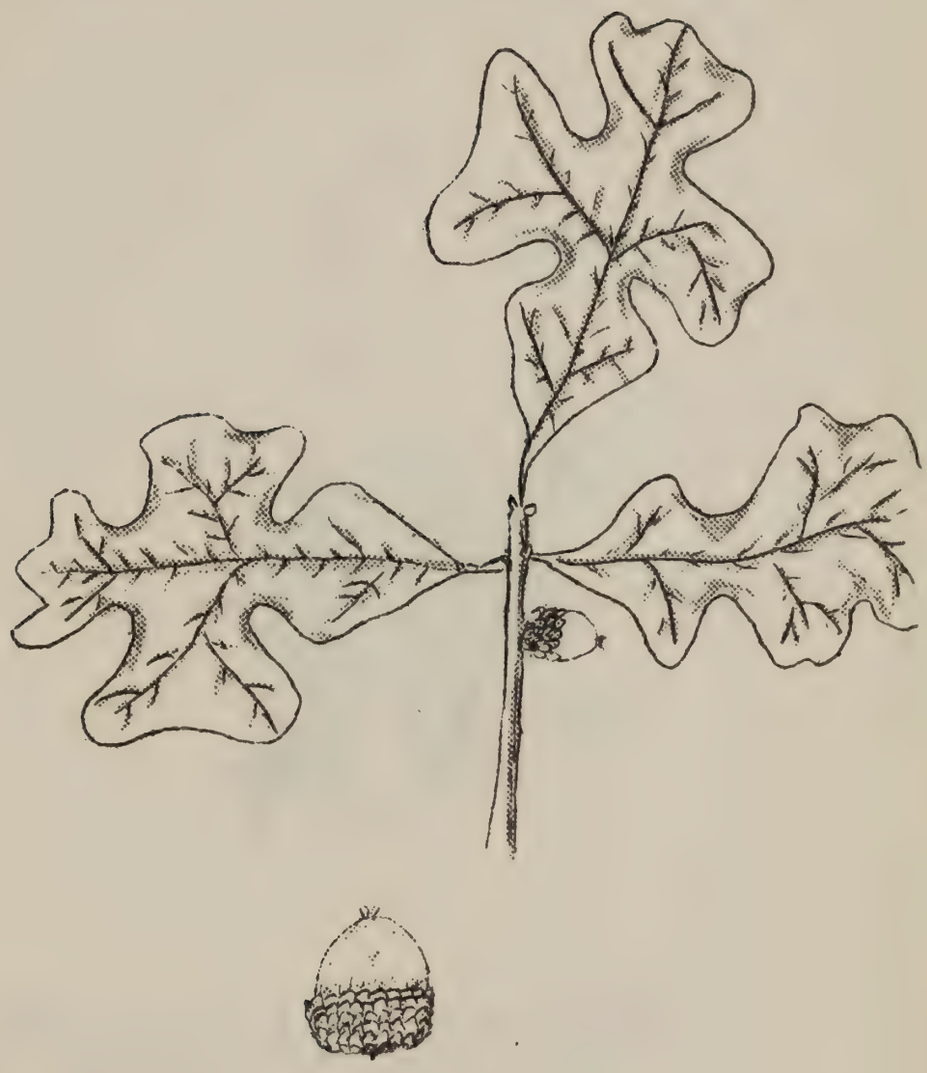
# BURR OAK



The burr oak is found growing along streams on rich bottom lands or fertile hillsides where sufficient moisture is available. It has a short, thick trunk with heavy spreading branches, but is rarely over 75 feet in height.

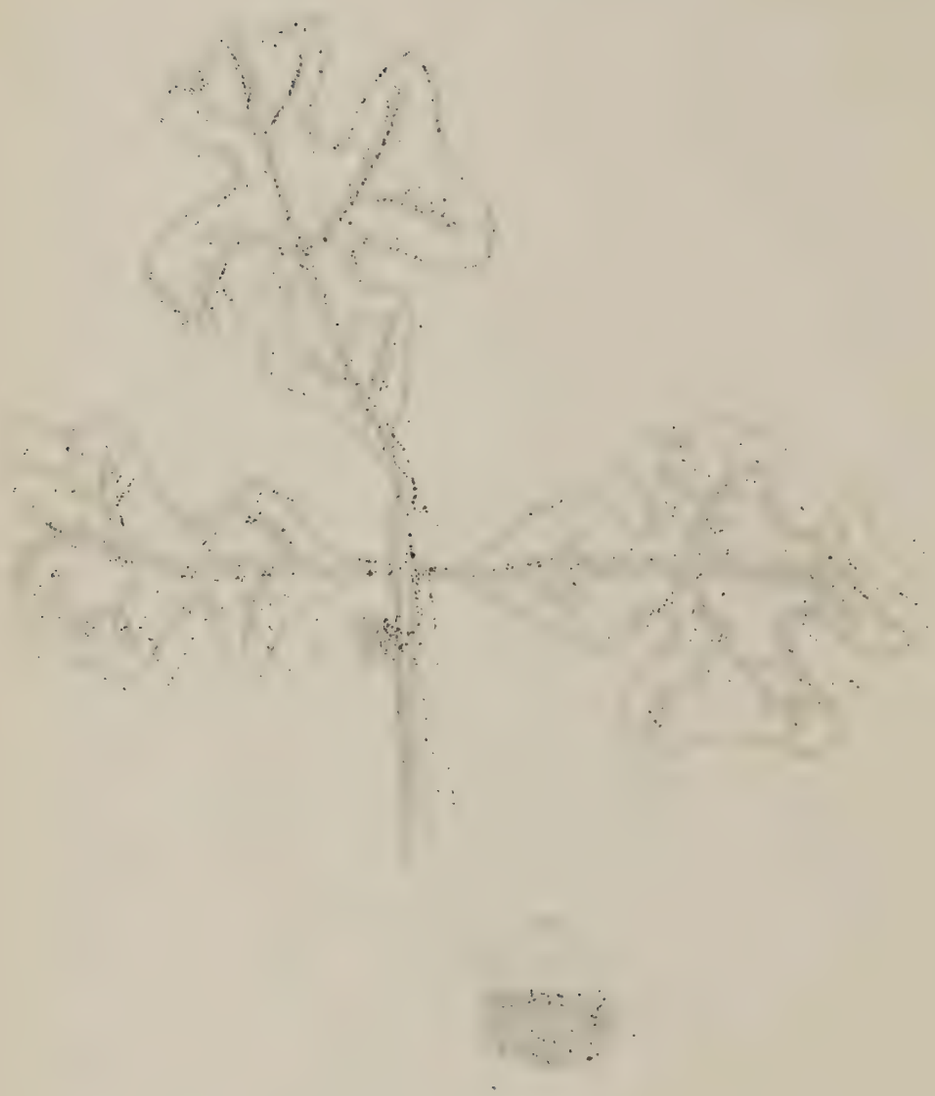
It is a desirable tree to plant under favorable conditions. The wood is heavy, hard, strong, tough and durable. It is used for timber, cross-ties and fuel.

# POST OAK



Post oaks are scattered over the entire region, but are found in large quantities in the eastern section. The trees are only medium in size, and often are from one to two feet in diameter, growing on the poorer soils.

The wood is hard, heavy, and durable in contact with soil. It furnishes large quantities of cross-ties, and fence posts, and in some places is used in the manufacture of furniture, as it is very close grained.



# SOUTHERN RED OAK

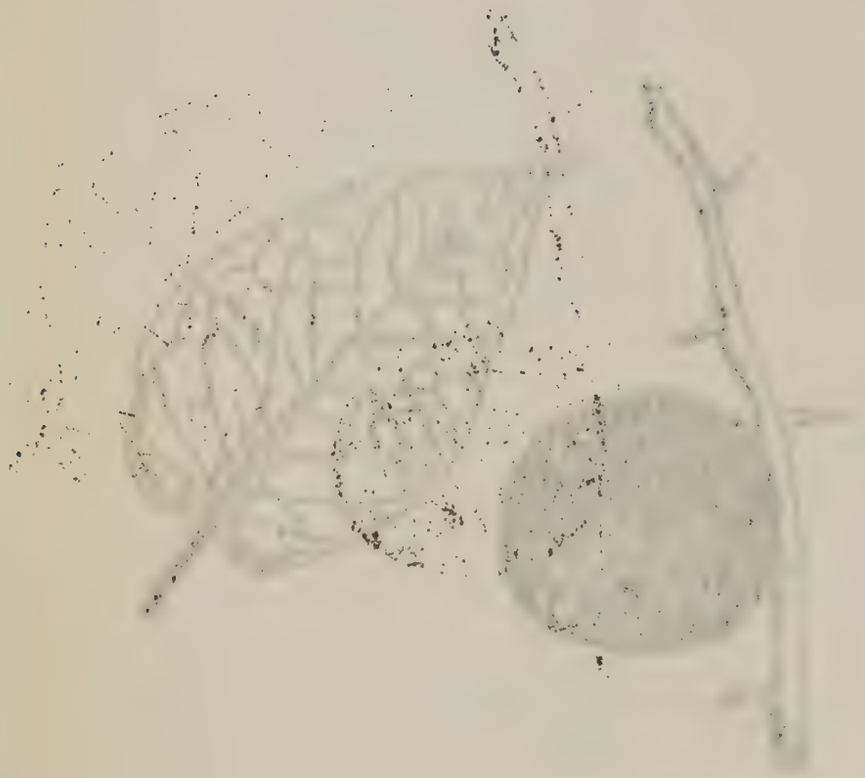
The tree commonly known as red oak grows in the eastern part of the region. It often reaches a height of 70 or 80 feet, and has a straight trunk, which is often 2 or 3 feet in diameter. It is especially adapted to the poorer and drier soils. This tree is desirable from both an ornamental and a commercial point-of-view.

The wood is heavy, hard and strong, although it is coarse grained. It is used for rough lumber, shakes (coarse shingles), furniture, chairs, tables, etc.

# OSAGE ORANGE

The osage orange or Bois d'arc tree is found most abundantly in the tributaries of the Red River, although the tree is found in most of the region, and is used considerably as a hedge fence. The tree may, under favorable conditions, reach a height of over 50 feet and have a diameter over 12 inches.

Bois d'arc wood is heavy, very hard and strong, and exceedingly durable in contact with soil. It is used largely for fence posts or for framework of bridges or buildings where in contact with soil. There is a very active demand for this wood.



# PECAN

This tree is native to this region and often grows to a height of 100 feet. It is commonly found along the lowlands and second bottom lands.

The pecan is grown largely for the edible nuts, but is a good shade tree, and the wood is strong and heavy, being used in some places in making handles and parts of vehicles. The wood checks badly and for that reason is not used in building.

# PERSIMMON

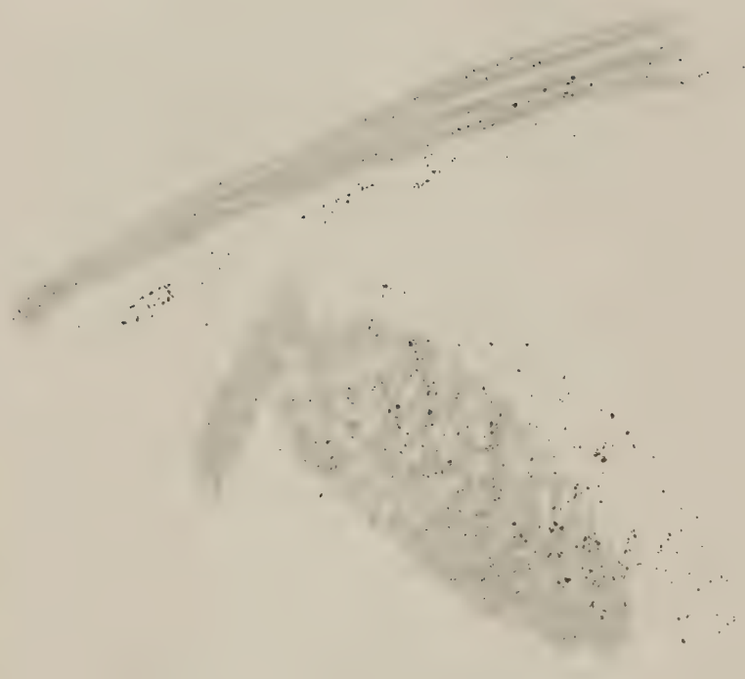
The persimmon is a small tree that generally grows throughout the eastern and central parts of this region. It prefers dry, open areas, and comes into abandoned fields, though it is also found on rich bottomlands.

The wood is valued for making shuttles, golf-stick heads, and other similar, special uses, but is not of sufficient commercial use to recommend its being planted on a large scale. Its fruits are valuable for wildlife.

# LOBLOLLY PINE

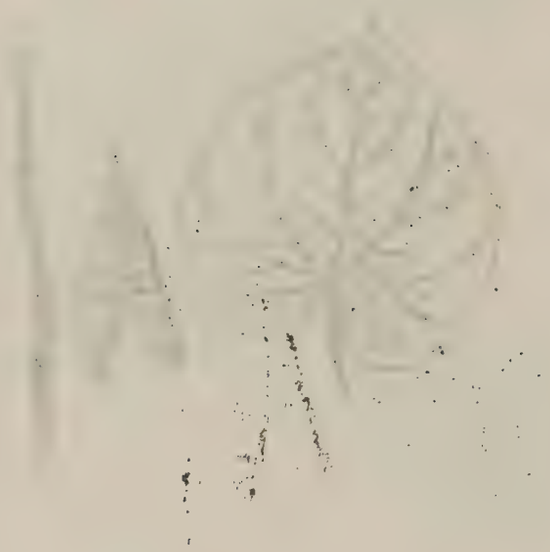
Loblolly pine is a fast growing yellow pine found in only extreme eastern part of this region, and especially well adapted to sandy soils that are well watered.

The wood is coarse-grained and suitable for building material, box making, barrel staves, piling, fuel, and pulpwood.

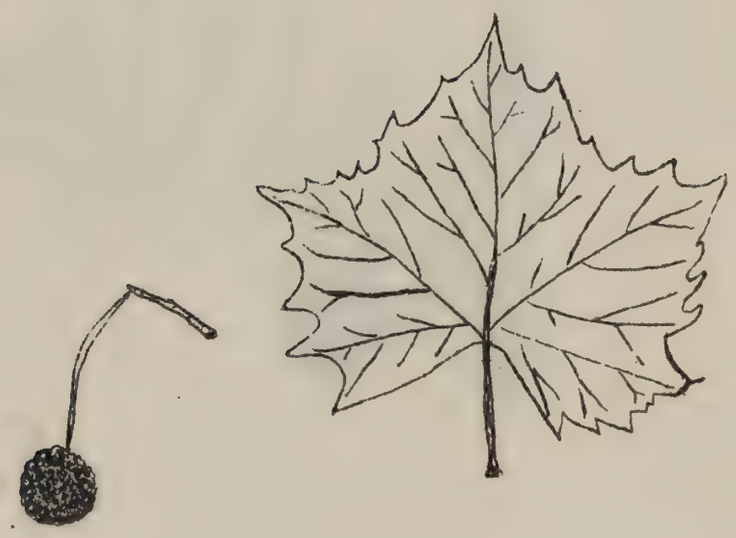


# REDBUD

This picturesque tree or shrub is found over much of this region, but particularly in the eastern part. It grows from shrub size to from 25 to 50 feet in height, and sometimes has a trunk, that exceeds six inches in diameter. It is largely planted as an ornamental tree, but its fruit furnishes some food for wildlife.

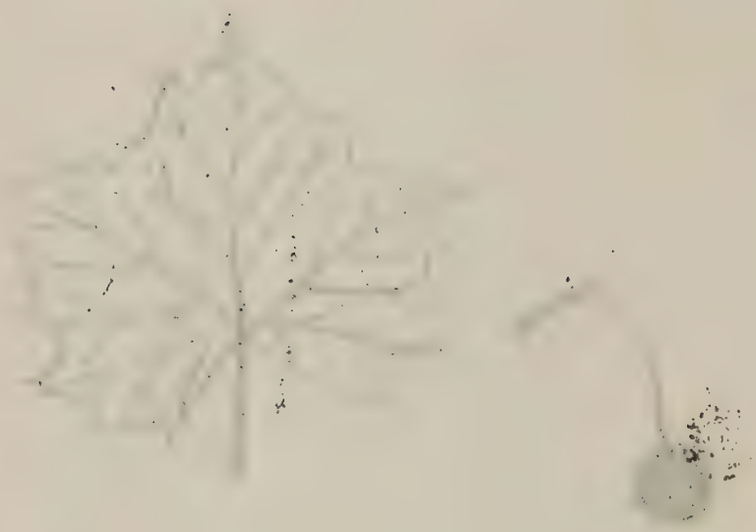


# SYCAMORE



This is the largest hardwood grown in this region. It is found along streams and on rich land. It is one of the more rapid growing trees and has been successfully used as a shade tree.

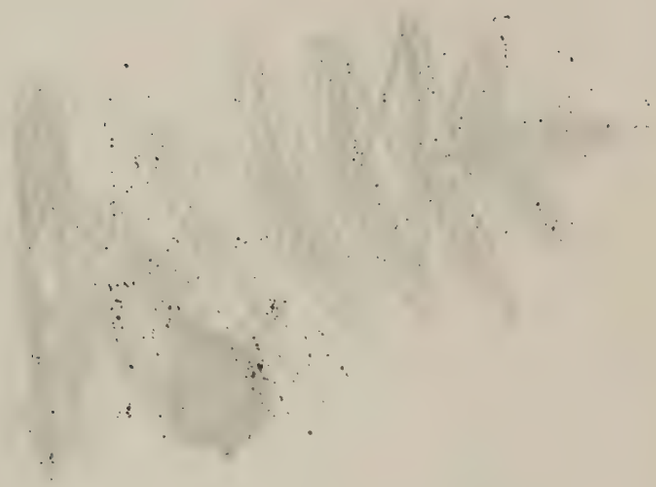
Sycamore wood is hard and moderately strong, but decays rapidly when placed in the ground. It is used for butchers' blocks, some kinds of furniture and interior finish.



# BLACK WALNUT

Black walnut is one of the very desirable forest trees and worthy of further planting. It grows to a height of upward of 100 feet, and has a straight trunk often clear of branches for half its height. It grows best on rich bottom lands or moist, fertile hillsides in the eastern part of this region.

Because of its dark brown color, its density, great strength, and susceptibility to a high polish, the wood is very much in demand for furniture, and cabinet work, gun stocks, and airplane propellers. It is easily propagated from nuts and grows rapidly.



## SEEDING AND PLANTING

The planting of forest tree seeds and seedling on areas to be reforested is a matter to which careful thought should be given. In most cases it is not advisable to plant seeds directly, but rather to plant nursery stock one and two years old. The planting of wildlings (seedlings taken directly from the woods), too, is in most cases inadvisable, for the reason that the stock is usually older than desirable, and the additional fact that the root system of wildlings is more spreading than that of seedlings grown in a nursery. Consequently, great care is necessary to see that as much of the root system is taken up with the top of the wildlings as possible and that the root system does not dry out at any stage of the transplanting operations.

1. The first matter to be considered in planting operations is the spacing to be used. The number of seedlings required per acre for planting with various spacings are as follows:

| Spacing | No. of Seedlings per Acre |
|---|---|
| 5' x 5' | 1,742 |
| 6' x 6' | 1,210 |
| 6' x 8' | 908 |
| 8' x 8' | 681 |
| 10' x 10' | 432 |

In general it is felt that for areas in Region VIII a spacing of 6' x 6' is satisfactory. However, other spacings may seem desirable for specific areas, and in such cases the matter should be carefully considered before operations are begun.

2. Under ordinary circumstances no preparation of the

ground will be necessary for planting. But in some cases where erosion is bad, or for other reasons, some soil preparation may be needful (such as, contour furrows or terracing), in which case it will be advisable to plant on the furrows or on the upper side of the terraces, where the moisture conditions will tend to promote growth.

3. The organization of planting crews is the next step after the seed or seedlings are available, the planting area is selected, and the ground is prepared, if preparation is seen to be needed. Two-men crews are usually most economical and efficient, one man to carry the planting stock and the second man to do the actual planting.

4. The stripping of the planting area so that the spacing is uniform is another preliminary step. It is suggested that the rows be laid out six feet apart (or such other width as has been determined), and their ends at either side of the planting area be indicated by poles with white or colored rag streamers on them. The planting crew can then keep a sufficiently straight line by sighting from one pole to the other and the spacing along the row can be sufficiently accurately determined by pacing, if it is borne in mind that ordinarily a man by slightly lengthening his pace will pace three feet. Two paces, then, are equal to six feet, or near enough for all practical purposes. If planting is done along contour furrows or on terraces, the contours and terraces should be followed with the spacing between seeds or seedlings,

such as was previously determined - six feet in most instances.

5. The main thing to watch in all planting operations is that the planting stock does not dry out at any stage of the operation. This refers particularly to the root system of seedlings.

6. In planting tree seeds directly, care should be taken to see that the seeds are not planted too deeply in the ground. Three or four times the width of the seed is the depth which is ordinarily recommended for planting. For example, acorns should be planted about 1½ to 3 inches deep; hickory nuts from 2 to 3 inches deep; walnuts about from 3 to 4 inches deep; Kentucky coffee tree beans about from 1/2 to one inch deep.

7. When seedlings are being planted, the stock upon receipt, unless it is to be planted immediately, should be unwrapped and the trees separated out of the bundle and "heeled in" in a trench. This trench should be about a foot deep, and run east and west. The north wall should be perpendicular and the south side sloping at an angle of from 45 to 60 degrees. The seedlings should be placed in the trench so that the tops will be toward the south and will partially shade the ground. If additional shade is needed, as is sometimes the case, strips of burlap, or some other material, may be put on frames above the stock in such a manner as to shade it. When the trees have been placed in the

trench, dirt should be placed over them clear to the top and firmly pressed around them. The stock should be kept moist until needed for planting.

8. The actual planting operations are best conducted by a two-man crew, as previously stated. Arrangements should be made so that the planting stock will be delivered to the planting crew as needed and in quantities easily handled. A convenient method for handling the stock is in buckets. If larger buckets are not available, 14 quart buckets will serve. There should be a layer of thin mud in the bottoms of the buckets sufficient to cover the roots of the seedlings. And in this manner the planting stock may be conveyed to the planting site and delivered to the planting crew for use. One man should carry the planting stock, and the second man should pace along the row and do the actual planting. Several tools may be used for planting - an axe-back mattock, a long handled, pointed shovel, or preferably a planting tool, of which several varieties are on the market. The mattock, shovel or planting tool is thrust into the ground at the point where the seedling is to be placed, and then pulled back, so as to make a hole into which the seedling may be set. The seedling to be planted should be grasped between the thumb and fore-finger and held in the hole so that it is at a depth slightly lower than when it was in the nursery bed. Then the roots are spread out with the free fingers.

When the tree is in place, pull out the tool and press the earth firmly about the roots by again inserting the tool in the earth a few inches from the seedling, and pulling the tool toward the seedling. Then tramp around the seedling lightly to insure that it is firmly in the ground, and that no air holes are left around the plant. This process is continued until the entire area has been planted.

9. The time to plant is anywhere from December 1 until about March 31. Usually in this section it is better to delay planting operations until after January 1, and such operations can often with advantage be carried on in February and March, when the weather is milder and there are not apt to be so many days lost. In some exceptional seasons the planting operations may be safely carried on into April. The main idea is that the newly planted stock shall have enough moisture to get firmly established before the dry summer sets in.

10. Planting irons or bars of several types may be purchased at a cost of from $20.00 to $25.00 per dozen. Planting mattocks with extra long blades may also be purchased at a price of about $16.00 per dozen. Long-handled, pointed shovels are generally available, but are not ideal planting tools. Planting irons or bars are probably the most satisfactory planting instruments.

11. Where wildling stock is used, as heretofore stated, ade-

quate arrangements should be made to insure the root system of the wildling stock from drying out. Since the wildlings are usually scattered and the collecting of any large number is a prolonged operation, this is a major consideration. It is better to gather wildlings for planting when the ground is wet, or at least damp, since under these conditions the root system of the individual plant is less likely to be seriously disturbed. In this connection it should be borne in mind that the younger the wildling the greater its chance of survival, since the top for which the root system has to supply moisture is smaller and does not cause a large drain on the root system before the root system is firmly established in its new location.

## SEED COLLECTION

The collection of seed of forest trees for planting on the project areas involves some features which deserve particular mention:

1. In the first place, it is of interest to know when to gather tree seed. Most tree species ripen their seeds in the fall. A few, however, such as maples, elms, willows and cottonwoods, ripen their seeds in the spring or summer. The exact time at which the seed of any particular species will ripen and be ready for gathering is a matter of observation, since it varies somewhat with the locality, and even among individual trees in the same locality.

2. The seed collector should be certain of the tree species he is collecting, so that there may be no mixture of species, and the tree seeds may be properly labeled. Some tree seeds are easy of identification, as black walnuts, persimmon, redbud and others. But some species are difficult to identify and distinguish, except to an experienced collector or a dendrologist. For example, it is often difficult to distinguish between the acorns of the various species of oaks, or the nuts of the various species of hickories. Nevertheless, the exact species planted should be known.

3. It is always advisable to secure tree seeds from locations as near the area to be planted as possible. It is also advisable to gather tree seeds from individual trees that are straight, vigorous and in other ways physically per-

foot. And, further, it is advisable to gather the tree seed from the upper portions (upper two-thirds) of the tree, since the seeds from this part of the tree are usually of superior quality. The reasons for the above suggestions should be obvious.

4. A complete record of the tree seed should be kept, including date gathered, place gathered, by whom gathered, and any other information of interest or importance.

5. Arrangements should be made for storing the seeds and caring for them in advance of actual gathering operations. It is necessary to protect the tree seed from rodents, from worms or other forms of devastation. As soon as the seed is gathered it should be brought to some central point for preparation and storage. In a good many cases considerable work is involved in separating the seed from the seed container or covering; but this should be done and the seed then dried and stored in sacks or bags. Asfar as possible all defective seeds should be culled out; but, except in the case of the larger seeds species, such as the oaks, hickories, etc., this is often impossible, so that the bad seed will have to be planted with the good and allowances made for the number of seeds that will not germinate. To find out the percentage of seeds that is likely to germinate several methods may be used; but, generally speaking, the sandflat method is simplest and least expensive. An ordinary sand-flat is $10\frac{1}{2}$x$10\frac{1}{2}$x$3\frac{1}{2}$ inches inside, made with sides of 1" pine strips and bottoms of

tongue and groove ½" pine flooring. Twenty-five seeds are sown in each of 10 drills and records kept for each drill. The germinating seeds are pulled as soon as they break through the sand. Each germinated seed counts 4%. The sum of all the seeds germinated in the flat divided by 10 is the germination percentage that may be expected.

6. When the seed has been properly dried, it should be stored in paper sacks or cloth sacks in a cool, dry place, and out of the way of mice and other rodents. If the seed is to be kept some time, cold storage is preferable, since tree seeds lose their germinating ability within a short time, unless kept in cold storage, and then they should not ordinarily be kept for a longer period than a year. Such seeds as walnuts, acorns, hickory nuts, pecans and some others may be stratified after collection in the fall, and kept fresh and moist until they are planted in the spring. To stratify seed either a large box should be buried in the ground or a pit should be dug. When this has been done about two inches of sand should be put in the bottom of the pit or box, then a layer of seed, and this process continued until the box or pit is filled. The box or pit should be lined and covered with fine mesh wire to keep out rodents and birds. A wire cloth with a mesh 16 to the inch is satisfactory. The top is left open to the weather and the seeds will be in good condition to plant in the spring.

7. In the first place, it is highly desirable to have definite information with regard to the source of tree

seed; i. e., the locality in which it was gathered, and for the purpose of recording exact information, cards will be provided on which the information may be entered. These cards will also be shipping tags and may be used to ship seed to the nursery at Muskogee or to other points. The collector should feel responsibility for making careful records with regard to seed collected.

8. For the purpose of records, so far as Region VIII is concerned, it will be sufficient to identify the states and localities in which seed are collected, since it is not probable that collection of seed will be made except on the project areas or in localities in close proximity to these areas. Later, if more project areas are developed, or if seed collection is more widely expanded, some division of Texas and Oklahoma into zones may be advisable.

9. An accurate record of seed gathered should have the following information:

a. Species

b. State and county in which gathered

c. Locality in which gathered

d. Whether gathered from lowlands or uplands

e. Whether gathered from indigenous trees or planted stock

f. Whether the trees from which the seed were gathered were selected specimens

g. Name of collector

h. Date of collection

10. Tree seed should be gathered from trees that are hardy, thrifty and of good form. The collector should not gather seed from decayed, defective and malformed tree specimens. Seeds gathered from the upper two-thirds of the tree are usually of better quality and more likely to produce seedlings than those from the lower part of the tree, for the reason that they are more apt to be fertilized. Such seeds as acorns, walnuts, hickory nuts, pecans and some others may be gathered from the ground, but most seeds will have to be gathered from the trees by means of ladders or by climbing the trees. Sometimes a long pole with a sharp cutting arrangement on the end may be used, or in some instances, seed may be obtained where logging operations are in progress.

11. The seed crop should be closely watched so that the seeds may be gathered just at the time when they are ripe. Immature (unripe) seed does not keep well, nor does it have a high percentage of germination. If the gathering is delayed too long the seed may fall or be shaken to the ground by a high wind or a sleet storm so that it is hard to gather or cannot be gathered at all.

Seeds of our common trees which ripen in the spring or early summer are:

| | | |
|---|---|---|
| Elms | Cottonwood | Mulberry |
| Maples | Willow | Plum |

Seeds of native species which mature in the late summer or fall are:

| | | | |
|---|---|---|---|
| Oaks | Walnuts | Hackberry | Ky. coffee tree |
| Ashes | Hickories | Box Elder | Sumac |
| Pines | Persimmon | Black Locust | Haws |
| Red Cedar | Redbud | Honey locust | Cherry |
| Catalpa | Sycamore | Osage Orange | |

12. Since fresh seed heats if allowed to stand in large piles or packed in quantity too rightly in large sized containers, care should be exercised to see that the supplies of seed gathered are well aerated (i. e., well ventilated) after gathering, while being transported to the place of storage and while in storage. The store-house should be as dry and as cool as possible, and as much circulation or air as possible should be provided.

13. The different kinds of seed require different treatments to clean them properly. Cleaning of the seed should be done as rapidly as possible after its receipt at the storehouse. After the seed has been cleaned it should be dried. This may be done by spreading the seed on canvas sheets or tarpaulins where there is plenty of air circulation. It is better to do this in a shady spot or under cover so that the drying out process may not be too rapid. The seed, however, should not be dried out too much, since this destroys its germinating ability. After the seed is cleaned and dried it should be stored in sacks or trays in as cool and dry a place as feasible and should not be packed tightly so that it will heat, but should be aerated as much as possible. Cold storage is preferable. Cold moist storage where the temperature is slightly above freezing is probably the most satisfactory. It is desirable to plant the

seed as soon after gathering as circumstances permit.

Frequent inspections of seed in storage should be made to make certain that they are not being eaten by rodents, worms, weavils, or other destructive agencies or are otherwise adversely affected.

NURSERY WORK

The work on the forest tree nursery established on Project LD-OK 2, the Cookson Hills Development Project, Muskogee, Oklahoma, should in the main follow the nursery practice as set forth in the manual covering "Seed and Nursery Practice" for the Shelterbelt Project as developed by the Forest Service, U. S. Department of Agriculture.

Any deviations from the practice set forth in the above manual will be such as are necessitated by purely local conditions or such modifications or changes as own experience may show are advisable or necessary.

Such changes or modifications will be a gradual growth and cannot even be indicated at this time.

Matters pertaining to water supply, general lay-out of the nursery, necessary equipment and others are purely local problems which will have to be worked out on the ground and are not subject to general rules.

The buildings which will eventually be needed on the nursery are a matter for future consideration. But it is probable that a building for the extraction, drying and storage of seed will ultimately be necessary in addition to the buildings already erected. A properly equipped seed extracting plant should have the following:

1 - motor (if power is available)
1 - macerator
1 - fanning mill
1 - rotary dryer
1 - large fan
tanks, barrels, stratification boxes and storage cans

## TRUCK TRAILS

In the construction of truck trails the standards set up by the United States Forest Service should be followed. These standards have been set forth in the "Forest Truck Trail Handbook", a copy of which has been sent to each project.

The attention of the Project Managers and those responsible for the actual construction of truck trails is called to some particular features of this work.

1. Alignment. A careful preliminary reconnaissance of the proposed route should be made to determine the best alignment possible for the trail and all feasible routes considered. As few curves as possible are decidedly advisable; also, as few bridges as possible. It is felt that very few bridges, if any, will have to be constructed on the present projects. Sofar as feasible the truck trails should follow ridges for several reasons. The trails are more easily and economically maintained, the drainage largely takes care of itself, such trails are usually of advantage in locating forest fires, and are of more value as fire-breaks on a ridge than on a side-hill. The preliminary survey of the trail, in case there are bridges to be constructed, should take into careful consideration the approach to the bridges. Bridges on a curve are distinctly inadvisable. The ground where the bridge is to be built should also be carefully investigated to see that there is a solid foundation for the proposed structure. Sofar as possible the alignment of the trail

should cross a stream at right angles. If the stream is small, this can sometimes advantageously be effected by changing the course of the stream. When the alignment of the road has been satisfactorily determined it should be staked out along the center line with stakes 50' apart and marked with the station number, beginning at either end of the trail.

2. Grade. With modern trucks and cars the grade of a truck trail is not so important a matter as the alignment. Except under unusual circumstances, and providing the riding surface is reasonably smooth, a modern truck or car will easily negotiate a fairly steep grade, if not too sustained. Ordinarily, a grade up to 10% for short distances (so-called pitch grades) may safely be used.

3. Right-of-way. For our purposes, what are known as low-service, single-track truck trails are sufficient. A right-of-way, therefore, of 20 feet should be cleared. Before work is begun the ownership of the land which will be within the right-of-way should be determined, so that permits or leases may be secured where necessary. The outside limits of the right-of-way should be marked by setting stakes 10 feet on either side of the stakes set for the center line.

4. Clearing. The right-of-way should be cleared of all trees, brush and debris. If this is done with hand labor to utilize the largest number of men, all trees should be grubbed

out below the surface of the ground, but it is not necessary to cut the tree off above the ground before the grubbing is done. After the tree has fallen, the branches should be lopped off and the trunk cut up into convenient lengths for burning. If, however, there is material in the tree trunk which it is desired to use on the job, or for which there is a market, the trunk may be cut into the specified product on the ground, or cut into suitable lengths and rolled outside the right-of-way for future manufacture. All brush should be cut off at ground level. All waste material, slash and debris should be piled in the middle of the right-of-way and burned, and this operation should keep pace with the balance of the clearing. Care should be taken to see that the burning is complete and that the fires do not get out of control and off the right-of-way. Stones or rocks in the right-of-way, which will seriously interfere with the grading, should be removed.

5. Grading. The actual grading should be done with a tractor and grader. A grader with a 10' blade is suitable for low service truck trails. The truck trail should be bladed up so that it has a 10 foot crown and with bar-pits (or side-ditches) not over eight or nine inches deep. Deep bar-pits (lateral or side-ditches) are entirely unwise and unnecessary, as will be explained later. When grading is done on a side hill, or where there is a pronounced slope away from the side of the trail, bar-pits are not needed.

Where a fill is necessary, the crown should be 12 feet, but through a cut, 10 feet is sufficient. The shoulder from the crown to the bar-pit should have a 4:1 slope, so that the total width of the road is actually 18 feet. A crew of one or two men, each with an axe or mattock, should follow the grader, to cut out and throw outside the right-of-way roots and small stumps not otherwise removed. (See Figure 201, Page 208, Truck Trail Handbook).

6. Drainage. Drainage may be secured where needed by wing-ditches; that is, ditches which gradually lead the water off the road for some distance and allow it to be distributed over the adjacent areas and away from the trail. The construction of wing ditches can best be illustrated by reference to the attached blue print. Such drainage has several advantages. It takes the water away from the road gradually without any abrupt change in direction, and allows the water to be distributed over the land adjacent to the road. There should be no perceptible angle where the wing ditch leaves the road. The number of wing ditches needed will be determined by the length and degree of the grade. Sufficient wing ditches should be constructed so that the water in the barpits does not have any opportunity to gain force or volume. The "plugs" at the mouth of the wing ditches should be packed firmly when the ditch is constructed and preferably seeded or sodded to Bermuda grass. These plugs should be from 12 to 15 feet long. Culverts, when it is necessary to construct them, should

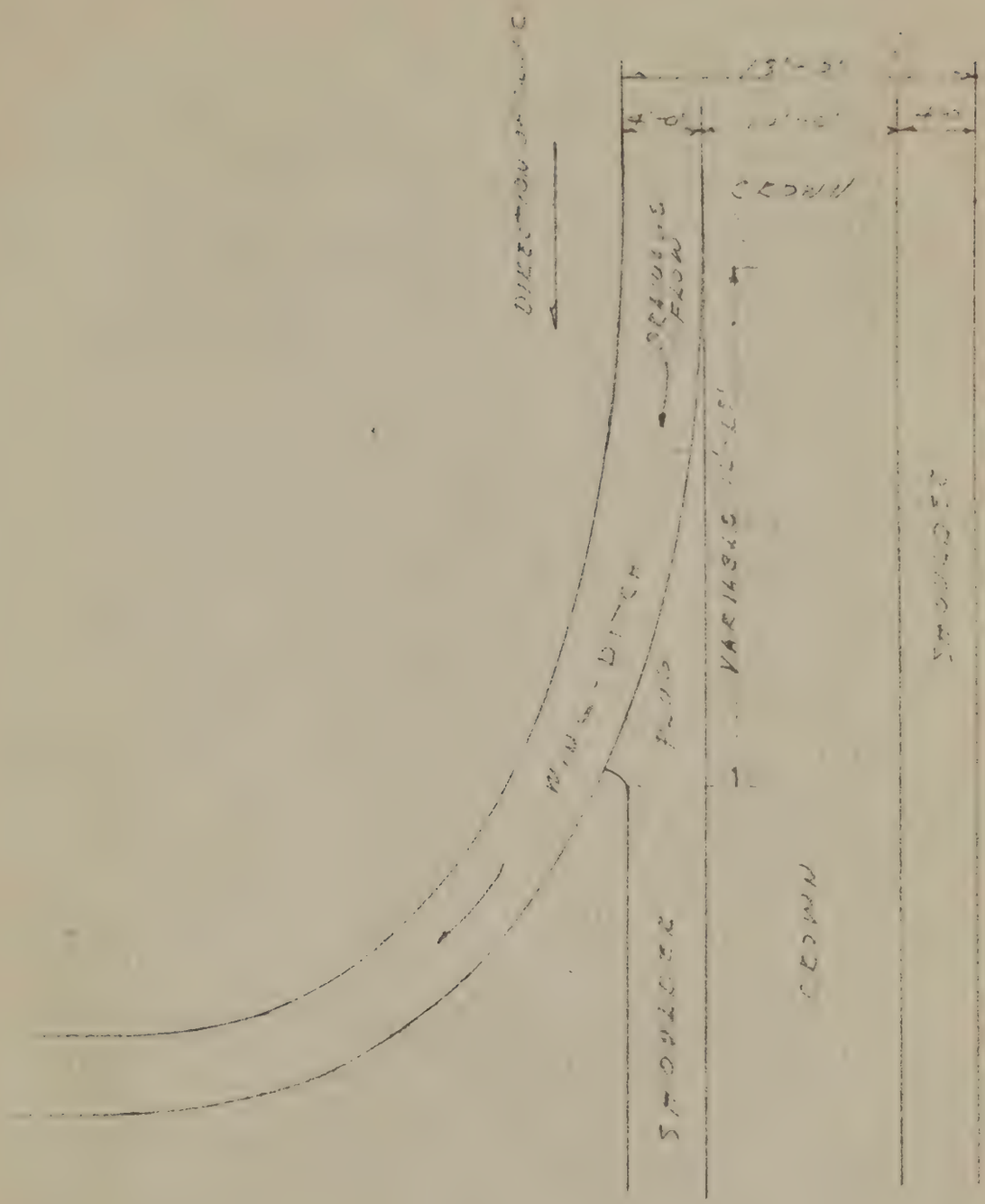


DIAGRAM SHOWING WING-DITCH CONSTRUCTION
FOR TEXAS TRUCK
SCALE 1"=10'-0"

be constructed on piling sunk far enough into the ground to insure a firm foundation. It will usually be possible to put in the piling with post-hole diggers. No culverts should be constructed of durable material. The piling, caps and stringers should be of such material as post oak, bois d'arc, mulberry, or species known to be lasting in contact with the ground. All material used in culvert or bridge construction should be pooled.

The decking should be of oak planks three inches thick. The deck of the culvert should be on a level three or four inches higher than the level of the crown of the road in order that the culvert may not be in a sink in the road, if, later, surfacing material is found necessary on the crown resulting in raising the general level of the road. Six inch wide bulkhead planks should be used to face both ends of the culvert at the top, so placed that the top edge is level with the upper surface of the decking. From the lower edge of the facing planks to the ground rougher material, such as, split poles, may be used. The idea, of course, is to prevent dirt from sifting into the culvert when a fill is made at either end of the culvert to provide a smooth approach. It may sometimes be necessary to get water from one side of the road to the other for easy disposal, as on a side-hill. In such cases a culvert is necessary.

7. Maintenance. The object which should be kept constantly in mind in truck trail construction is a small maintenance cost after the road is finished, since the probabilities

are that small funds, if any, will be available for maintenance after the truck trail is once finished. Nevertheless, some maintenance will undoubtedly be needed. If the trail is not surfaced, it is apt to rut considerably, and, if there is much grade, water is likely to run down the ruts eroding the trail pretty badly. In such cases the advisability of additional wing-ditches should be taken into consideration and the trail subjected to a light regrading to eliminate the ruts. If a "maintainer", either horse-drawn or power, is available, this can be used to advantage on such work. Brush should be removed, ditches cleaned out when stopped up with leaves or other litter, holes resulting from any agency filled up, culverts and bridges inspected, and any other steps taken to put the road in the same condition as it was upon the original completion.

8. Turn-outs. On single track truck trails turn-outs are needed, unless the trail is quite short in length. The distance between turn-outs will depend considerably upon the topography of the country through which the truck trail is constructed. Turn-outs are most advantageously constructed on curves - especially blind curves - and at the top of sharp pitches. Roughly, they should be about one-half mile apart, and intervisible if possible. Turn-outs should be 75 feet long from end to end. The crown of the trail should be widened out on both sides of the truck trail for a distance of 25 feet until a crown of

CLASS A OF TURN-OUT FOR SINGLE TEAM TEAM TRAIL
SCALE 1"=10'-0"

20 feet is attained. This width of crown should be maintained for a distance of 25 feet, when the crown should be narrowed again for a distance of 25 feet until it is again 10 feet wide. However, if turn-outs are constructed on a curve, the entire increase in width of the crown to 20' should be thrown on the outside of the curve. The turn-outs should be staked out and constructed as part of the construction operation, and not left until after the clearing and grading operations are otherwise completed. On the project areas, as at present constituted, it is felt that turn-arounds are entirely unnecessary.

9. Check Dams. Under exceptional conditions small check dams may be necessary in the bar-pits to slow up the water and prevent erosion. These may be constructed of stone if convenient.

## TIMBER HARVEST

By timber harvest is meant the sale or disposal otherwise of all timber or other forest products cut on the project areas. Timber may be cut on the project areas in the process of developing the area, as in clearing a reservoir site. Or it may be cut in the process of improvement or management of the forest stand. Such timber, if it is at all suitable, may be sold either as logs or in the form of some manufactured product as posts, cordwood or ties. Or timber cut may be manufactured on the area into material suitable for use in various ways. Any or all of these methods of cutting and disposal of timber constitutes harvesting the timber. Further, surplus timber or forest products may be sold under certain conditions as outlined in Administrative Order 72, Revision 1, Supplements 1 and 2. Copies of these may be obtained from the Regional Contract Representative, Michael J. Haile.

There will probably be an increasing amount of activity coming under this head as time goes on, and if the project areas remain for administration in the hands of the Resettlement Administration.

## TIMBER ESTIMATE AND SURVEY

As a basis for future planning it is highly desirable that a survey of the timbered areas be made to determine the kind, amount and types of timber at present on the ground. The present timbered areas should be mapped so that their boundaries are reasonably approximately located. As a basis for future planning, too, it is important to know something of the condition of the present stand and rate of growth. All this information can only be obtained by a crew of trained men, who can make a careful study of the present forest stand. Nothing of this sort has so far been attempted. Nevertheless, it is not only desirable, but necessary if careful forestry work is to be continued on the project areas.

## STUDIES AND EXPERIMENTS

The region in which our present project areas are located has been little studied from a forestry standpoint, and exceedingly little accurate information is available in regard to tree species and forest stands encountered. Particularly, information is lacking with regard to growth and yield of such forest cover as is typical of this region and accurate estimates of the average forest stand in different forest types.

To get the information desired and put it in a usable form would require special studies by technically equipped men, and it is hoped to arrange some form of cooperation with the Southern Forest Experiment Station so that a portion, at least, of the information desired may be obtained.

Also, it is desirable to establish permanent sample plots of varying sizes on which results obtained from certain forms of treatment may be checked and recorded from time to time.

Such work is highly specialized and for the most part requires the attention of technically trained men, but the results when obtained are important in planning future forestry work on the project areas. For this reason it is desirable that some cooperative agreement be worked out with the Southern Forest Experiment Station so that the most important phases of this work may be early inaugurated.

Too much cannot be said of the importance of such studies.

Accurate information with regard to the amount of the present forest stand and the possibilities of growth and yield are vitally essential features in computing data in land use planning.

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